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Cattle Killing- Floor Systems and Layouts

Marketing Research Report No. 657

U.S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Transportation and Facilities Research Division

in cooperation with
Texas Agricultural Experiment Station

PREFACE

This report provides the meat-packing industry with data and guidelines that could be helpful to the industry in increasing the efficiency of killing-floor operations. The study deals primarily with the operations and layouts used in slaughtering 50,000 head of cattle with three different systems--the three-bed, the gravity on-the-rail, and the powered on-the-rail. The study is a part of a continuing cooperative program of research aimed at improving efficiency of the marketing of farm products. An earlier report, MRR-436, "Improving Methods and Facilities for Cattle Slaughtering Plants in the Southwest," described operations for small plants.

The author acknowledges the assistance of the many individuals of Colorado, Nebraska, Kansas, and Texas plants who devoted much of their time to make this study possible. Manufacturers of slaughtering equipment were also helpful in providing cost data. The Allbright-Nell Co. of Chicago, Ill., provided most of the photographs in this report.

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This work was conducted under the general supervision of George E. Turner, Marketing Research Analyst, Transportation and Facilities Research Division, Agricultural Marketing Service; and John G. McNeely, Agricultural Economist, Texas Agricultural Experiment Station. Mr. Turner died after completion of the research but before publication of this report.

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SUMMARY

Killing-floor operations in plants equipped with rail systems on which cattle are moved by gravity or powered drive (gravity on-the-rail and powered on-the-rail systems) cost about \$13,000-\$15,000 less a year for an annual volume of 50,000 head than in plants using a 3-bed system. (Annual labor and equipment costs for the 3-bed system are \$101,780.) The 3-bed system, in which cattle are moved manually on rails and removed from the rails to beds on the floor for certain work, has been the traditional system used by the slaughtering industry. This study was based on a killing rate of 24 head per hour, with the dressed weight of carcasses at 500-700 pounds. The methods described for performing operations were observed in field studies to be the most efficient for each system.

Labor and equipment costs per 100 head were \$203.56 for the 3-bed system, \$177.64 for the powered system, and \$173.33 for the gravity system.

Layouts showing the arrangement of equipment for efficient operations on the killing floor are suggested for each of the three systems. The layouts are planned to minimize walking and transport distances within and between work areas. Both rail systems require less floor area than the 3-bed system.

The killing rate in each system can be increased to 35 cattle per hour without an increase in floor area.

CATTLE KILLING-FLOOR SYSTEMS AND LAYOUTS

By

Donald R. Hammons, industrial engineer
Transportation and Facilities Research Division
Agricultural Marketing Service

BACKGROUND OF THE STUDY

In 1962 about 26 million cattle were slaughtered in meat-packing plants throughout the country. Cattle killing-floor operations--the work performed to transform the live animal into carcass sides, hide, and edible and inedible offal--are an important and costly part of meat-packing work.

The slaughtering industry, usually has used one basic system to perform killing floor operations--the bed-type system. This system requires manual performance of most operations. In recent years new systems designed around complex and mechanized equipment have been developed.

The purpose of this study is to compare the relative efficiency of the bed system and two of the newer systems and to develop a layout for each system that provides for maximum operating efficiency. Comparisons are based on a plant handling 50,000 cattle annually and slaughtering at the rate of 24 head per hour. Because the weights of cattle slaughtered materially affect the labor and equipment requirements, the assumed dressed weights are 500-700 pounds.

Research was conducted on cattle killing floors in 14 slaughtering plants in Colorado, Kansas, Nebraska, and Texas, and covered most basic variables affecting labor and equipment requirements. The study included all types of cattle, but variations in work caused by the grade, breed, or condition of animals before slaughtering were not specifically evaluated. Work done by inspectors and graders was not included.

Time studies were made of the work methods used in slaughtering cattle in each system. Labor requirements include productive labor and the unproductive labor or job-regulated wait time inherent in the system.¹ The methods described in this report are the most efficient for the particular volume and system as determined by the field studies. Methods can vary in each system; this report includes only the methods and equipment most commonly used

with each system in the plants studied. The time values established for performing operations should not be considered as standards but as guides for measuring the relative efficiency of each system.

Because of Federal, State, and local ordinances and requirements about sanitation, design, and construction of slaughtering plants, plans for new plants or expansion of existing plants should be submitted to the proper authorities.

Cost Determinations

Labor and equipment costs are computed on the basis of 100 carcasses. Supervisory, management, and facility costs have not been included; therefore, the data do not reflect total cattle dressing costs.

Wage rates for various operations vary within systems and by systems. They also vary according to the skill required for the specific operation. For the purpose of this analysis, a wage rate of \$2.75 per hour is assumed for all jobs. This rate does not include Federal Insurance Compensation Act taxes, unemployment insurance, and workmen's compensation payments made by the employer or such benefits as vacations and group insurance. Labor costs for a particular operation are determined by multiplying the hourly wage rate by the total man-hours of productive labor. Total labor costs for a particular system are determined by multiplying the hourly wage rate by the total man-hours of productive and unproductive labor.

Equipment prices were obtained from equipment manufacturers and are based on average f.o.b. factory prices for 1960 and 1961. Equipment costs are grouped into two major categories--ownership costs and operating costs.

Ownership costs include depreciation, based on the straight-line method and using life-expectancy tables from Internal Revenue Service Bulletin F; interest, based on a 6-percent rate of the average investment; and typical tax and insurance rates for the industry, a combined figure of 4 percent of the initial

¹ See "Description of Operations and Systems," p. 4.

investment. These costs are considered to be fixed and are computed on an annual basis.

Operating costs include fuel, power, and maintenance. Costs of electricity, at 2 cents per kilowatt hour, and water, at 0.03 cent per gallon, are representative of the areas studied. Maintenance costs vary widely for individual items of equipment. The maintenance costs are based on discussion with slaughter plant operators and on data obtained from equipment manufacturers.

Description of Operations and Systems

Killing-floor work consists of dressing-line and supporting operations. Dressing-line operations are the major work performed to prepare finished carcasses: Immobilizing the animal; bleeding it; removing the head, legs, hide, and viscera; sawing the carcass into sides; washing; shrouding; and weighing sides. Most dressing-line work is performed while the animal is suspended by its hind legs on overhead rails. Dressing-line operations are performed in sequence. Each operation can begin only when the preceding operation is completed. Thus, the operation requiring the longest elapsed time sets the pace for all operations. Operations other than the pace setter have varying amounts of job-regulated wait time equivalent to the difference between actual time required and the time of the pace setter.

Supporting operations consist of work performed on those parts of the carcass, such as heads and offal, that are removed in preparing the sides. Supporting operations are performed independently of one another and of dressing-line operations, except that the heads and other products are obtained as a result of dressing-line work.

Some supporting work may be performed on the killing floor, and some may be done in other parts of the plant. So that valid comparisons can be made of the killing floor systems discussed in this report, only those supporting operations that are performed on the floor, in all of the systems, are described. The layouts presented, however, provide space for all supporting work normally done on the floor in each system.

Many small elements of work are involved in slaughtering cattle. The manner in which these elements are grouped to form operations varies from system to system and from plant to plant. Operators attempt to combine the elements of work on the dressing line so that each operation takes approximately the same time, to avoid delay or wait time between operations.

Four basic systems are used in killing-floor work. Differences among these systems

occur in the way the carcass is moved on overhead rails, in the equipment used to work on the carcass and to aid in work on the carcass, and in the way the various elements of work are grouped into operations.

The bed-type system requires that carcasses be manually pushed along the rail and in one work area, removed from the rail to cradles on the floor, where one or more carcasses at a time are worked on. The number of beds used varies. A three-bed system is described in this report. It may be that there are some slaughtering plants dressing at the rate of 24 carcasses per hour with a two-bed system. However, such plants would be likely to have more workers performing operations than is suggested for the three-bed system discussed here.

In one of the newer systems, the carcasses are moved on the rail by gravity (the gravity on-the-rail system) through the major part of the operations; manual movement is required in only a few work areas. Carcasses remain on the rail and are worked on one at a time through all of the operations. They are lowered for certain work by drop rails (built-in sections of the overhead rail that lower the carcass from a few inches to 3 feet, as required).

A third system, also recently developed, is similar to the second in that carcasses remain on the rail and are worked on one at a time through all operations, but the major movement in this system is by powered drive (the powered on-the-rail system). This system also has gravity rail movement in some work areas and manual movement in others. It is the most mechanized of the three systems; six hydraulic platforms are used to enable workers to handle the work on carcasses more easily, compared to three in the gravity system and one in the bed system.

The fourth basic system, which also has powered drive, uses additional mechanical equipment, in particular a device to partially pull the hide from the sides of carcasses. This system is used mostly in plants slaughtering larger volumes than are considered in this report, and so it is not discussed further.

THREE-BED SYSTEM

The elements of work in this system are combined into 10 dressing-line operations which require 16 workers and 2 supporting operations which require 3 workers. The labor requirements for performing each element of work in each operation are given in the appendix. Labor and equipment requirements and costs are summarized in tables. Machine-hours and total times for equipment that come in multiples--such as "400 trolleys" or "75 feet of dressing rail" are given as single units for all components.

Dressing-Line Operations

On the three-bed killing floor, workers push carcasses along overhead rails to move them between most work areas. The rail system and work areas are shown in figure 1, and described below.

After the animal is "stunned", it is shackled by one hind leg and raised and dry-landed (placed) on the bleeding rail in work area 1. In work area 3, carcasses are lowered from the rail to cradles on the floor where they are worked on three at a time. The shackles are removed and returned to work area 1 on a shackle-return rail. Trolley hooks are then inserted in the hind legs of the carcasses. The trolley wheels are placed on hooks of

spreaders (devices that hold the legs of the carcass about 48 inches apart), which are permanently attached to hoists located above the ends of the three dressing rail spurs (work area 4). The carcasses are dragged across the floor by the hoists. When work in the fourth area is completed, the carcasses are raised to the dressing rail spurs, where the spreaders are removed. The carcasses are left suspended on the dressing rail by the trolleys. Carcasses are pushed along the dressing rail through the rest of the operations, and each carcass is handled individually. The crew organization and productive and unproductive labor for dressing-line operations are shown in table 1.

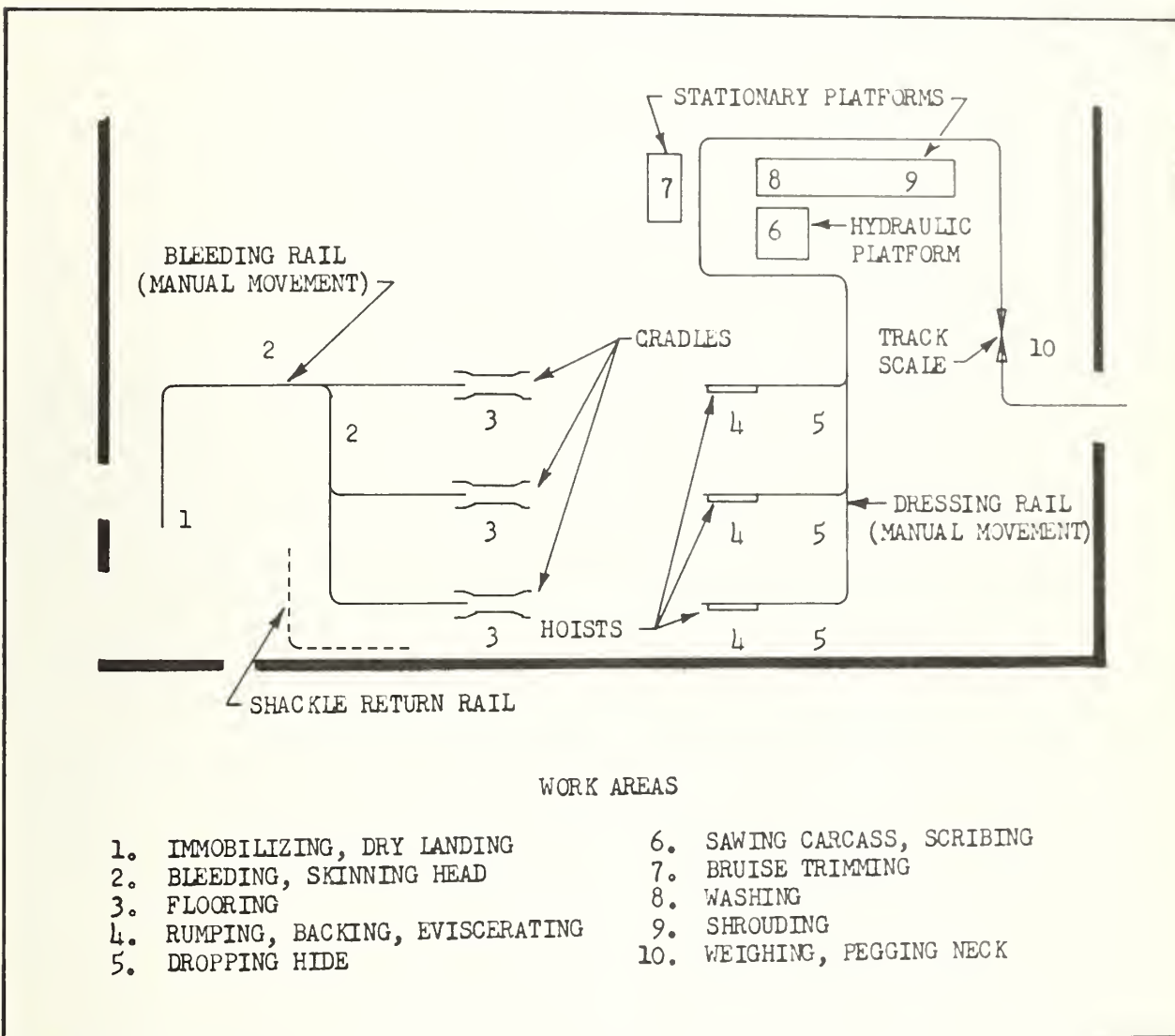


Figure 1.--Diagram of rail system and dressing-line work areas on the three-bed killing floor.

TABLE 1.--Three-bed killing-floor system: Crew organization and labor requirements to dress 100 cattle in 4.14 hours (24 head per hour)¹

[Based on dressed beef carcasses weighing 500-700 pounds]

Operation	Crew size	Labor requirements		
		Productive	Unproductive ²	Total
	Number	Man-hours	Man-hours	Man-hours
Driving, immobilizing, dry-landing.....	1	3.49	0.65	4.14
Bleeding, skinning head.....	1	2.46	1.68	4.14
Flooring.....	5	15.95	4.75	20.70
Rumping, backing, eviscerating.....	3	10.41	0	10.41
Hide dropping.....	1	3.72	.42	4.14
Sawing carcass, scribing.....	1	3.30	.84	4.14
Bruise trimming.....	1	2.11	0	2.11
Washing.....	1	3.59	.55	4.14
Shrouding.....	1	3.78	.36	4.14
Weighing, pegging neck.....	1	1.59	0	1.59
Total.....	16	50.40	9.25	59.65

¹ Rumping, backing, eviscerating is the pace-setting operation.

² Job-regulated wait time caused by irregular flow of work.

³ Rumping and backing require 8.28 man-hours; eviscerating requires 2.13 man-hours.

⁴ No unproductive labor is charged to dressing-line operations for the workers who eviscerate, trim bruises, and weigh, because they are assigned to other duties between cycles of their work on the dressing line.

In each operation that involves the use of a hand knife, the worker periodically washes his hands and tools in hot water.

Driving, immobilizing, dry landing.--One worker performs this operation, handling one animal at a time. He walks from the dry-landing area to the catch pens (average distance 60 feet), selects an animal, and drives it through a chute into the stunning pen. He shoots the animal at the base of the skull with a captive-bolt stunner and unlatches the revolving door of the stunning pen so that the animal falls onto the dry-landing area. Next, he lowers the automatic landing hoist, places the shackle wheel on the hook of the hoist, loops the shackle chain and hook around one hind leg of the carcass, and lands the carcass on the bleeding rail. During this cycle, he also unloads the stunner, loads a spare stunner, and intermittently throughout the day he washes the floor of the dry-landing area.

The equipment cost is based on the use of a revolving stunning pen door, an automatic landing hoist, and two captive-bolt stunners for 3.49 machine-hours each. Twenty beef shackles are used for 2.28 machine-hours and 100 feet of bleeding rail for 1.62 machine-hours. The total machine-hours are 14.37. Shells for the captive-bolt stunners are included in the equipment costs.

Bleeding, skinning head.--Bleeding and skinning the head is performed while the carcass hangs on the bleeding rail over the bleeding pit. The pit is bordered by a low curb and equipped with two combination blood and water drains. (These are two-holed drains with interchangeable plugs that allow blood to be drained separately from water). After the head is skinned, it is severed but left hanging on the carcass by the trachea and esophagus.

One worker performs the operation. He sticks the animal in the neck with a hand knife, and after the initial flow of blood subsides, skins the head, removes the ears, and trims the hide. Between each job in the operation he usually moves the carcass along the rail, and after skinning the head, attaches a tag on which he has written the lot number to identify the head with the carcass. (Heads are removed by a worker assigned to supporting operations.) The average distance carcasses are moved within the pit is 15 feet.

Equipment: Two blood and water drains, 100 feet of dressing rail, 20 beef shackles, and a sterilizing lavatory (lavatory with knife sterilizer attached) for 2.46 machine-hours each, for a total of 9.84 machine hours.

Flooring.--Flooring involves moving three carcasses on the bleeding rail to the skinning beds, lowering the carcasses onto cradles,

removing the legs of each carcass, and skinning the sides. The carcasses are positioned on the cradles of their backs.

A five-man crew is used and each worker alternates on the various jobs as needed. This arrangement, using workers trained for all jobs, allows delay or wait time to be kept to a minimum and is more efficient than assigning specific jobs to each worker.

At the beginning of the slaughtering day, a backlog of carcasses is accumulated in the bleeding area awaiting movement to the skinning beds. Workers from the five-man crew move one carcass onto each of the three spur rails in the bleeding pit which lead to the three beds in the flooring area and lower the carcass by friction dropper to the cradles. After the carcasses are floored, the five-man crew works as a gang on all three carcasses. In order to keep worker interference to a minimum, three men at a time work on one carcass while the other two work on one or both of the remaining carcasses. For each carcass, the shackle is removed and placed on the shackle return rail. Usually, three workers, two working on hind legs and one on front legs, skin and remove the legs at the knees and hocks and throw them into barrels. Cuts are made in the hind leg hocks between the bone and leg tendon (gam). The belly incision is then made while the weasand (windpipe) is separated and tied. The belly and sides are then skinned, brisket sawed, udder or pizzle removed, and aitchbone (pelvic bone) opened. After the sides of the carcass have been skinned, trolley hooks are inserted in the gams of both hind legs.

Equipment: Three cattle cradles, two sterilizing lavatories, three friction droppers, and a trolley storage rack are used for 3.19 machine-hours each; 20 beef shackles and 100 feet of bleeding rail are used for 1.07 machine-hours each, and 400 trolleys are used for 0.60 hour. The total machine-hours are 15.50.

Rumping, backing, eviscerating.--Rumping and backing (skinning the hide from the rump and back of a carcass) and eviscerating are performed by three workers. The worker who does the eviscerating also does some supporting work; only that part of his time spent in eviscerating is charged to dressing-line operations.

The rumping, backing, eviscerating operation requires the longest elapsed time, and is therefore the controlling operation of the dressing line. This is true in most plants that use beds.

As in flooring, there are work areas for three carcasses; these areas are directly across from the three cradles, and are at the ends of the three dressing rail spurs. Carcasses are landed on the spurs when rumping, backing, and eviscerating is completed.

The operation begins as work is completed on the three carcasses in the flooring area. One worker lowers a hoist in the rumping, backing, eviscerating area, and another carries

the spreader that is attached to the hoist across to the flooring area. The trolleys of the carcass are attached to the spreader, the carcass is dragged across the floor by means of the hoist, and raised to the "half-hoist" position (fig. 2). The two workers then rump, lie bump, and pull the hide from the tail and felt (fig. 3). Next, they skin the back of the carcass while the third worker eviscerates. The two workers then transfer the carcass to the dressing rail spur where the spreader is removed and the carcass is left suspended on beef trolleys. The workers then push the carcass about 10 feet along the rail.

Equipment: 3 hoists with spreaders and landers, and 400 trolleys for 4.14 machine-hours each; 2 sterilizing lavatories are used for 0.36 machine-hour, a paunch truck for 2.13 machine-hours, and 140 feet of dressing rail for 0.63 hour. The total machine-hours are 11.40.

Dropping hide.--One worker pushes the carcass on the dressing rail an average distance of 15 feet to his work station, positions the carcass for work, skins the neck, lets the hide drop to the floor, and throws it into the hide chute.

The equipment consists of 140 feet of dressing rail and 400 beef trolleys for 3.72 machine-hours each, and a sterilizing lavatory for 0.15 machine-hour--a total of 7.62 machine-hours.

Sawing carcass, scribing.--Carcass-sawing consists of splitting the carcass down the center of the backbone and scribing each half. Scribing includes cutting the chine bones almost through with a hand scribe saw and pounding them back.

One worker, who is stationed on a hydraulic platform, performs the entire operation. He walks from the hydraulic platform to a carcass hanging in the hide-dropping area, pushes the carcass to the platform, steps on the platform, raises it to the proper working level, spreads the carcass with a pneumatic spreader, cuts the tail muscle with a hand knife, and saws the carcass down the center of the backbone with a heavy-duty beef carcass saw. The platform descends slowly as the worker saws the carcass and is at floor level when the carcass is split completely. The worker then releases the pneumatic spreader, uses a hand-type scribe saw to scribe each side, trims the neck area with a hand knife, and pushes the two sides 10 feet toward the next work area.

Equipment: A beef carcass saw, a pneumatic spreader, a hydraulic platform, 140 feet of dressing rail, 400 beef trolleys, and a sterilizing lavatory are used for 3.30 machine-hours each--a total of 19.80 machine-hours.

Bruise trimming.--This operation involves removal of the spinal cord as well as trimming bruises with a hand knife. One worker pushes the sides to his work area, a stationary platform, about 3 feet high, and when the work is completed, pushes the carcass on the rail



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Figure 2.--A worker raises the carcass to the half-hoist position for the rump-ling, backing, eviscerating operation in the three-bed system.



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Figure 3.--Two workers skinning the rump of a carcass. The carcass is suspended on trolleys on a spreader.

toward the next work area. The total distance averages 15 feet. The job does not require all of the worker's time and he is assigned part-time to supporting operations.

Carcasses are inspected on the rail in the bruise-trimming area.

The equipment consists of a work platform, 400 beef trolleys and 140 feet of dressing rail for 2.11 machine-hours each--a total of 6.33 machine-hours.

Washing.--Each carcass side is washed with a high-pressure spray of water by a worker standing on a stationary work platform about 3 feet high. This platform is 20 feet long, and the far end of it is the work area for the next operation, shrouding. The worker pushes the sides to and from his work area, a total average distance of 6 feet.

Equipment: A cattle wash pump, a work platform, 400 trolleys, and 140 feet of dressing rail are used for 3.59 machine-hours each--a total of 14.36 machine-hours.

Shrouding.--Heavy muslin cloth, soaked in a brine solution, is pinned to each carcass side by one worker. At the beginning of the working day, and intermittently throughout the day, the worker carries shrouds, neck pegs, and shroud pins to the area. The cloths are kept in a container on the work platform. The worker first places a cloth around the hind shank so that it overlaps on the inside of the shank. He stretches the cloth tightly and pins it at intervals so it completely covers the outside of each side. From 7 to 12 pins are used on each side. He then pushes the sides on the rail an average distance of 8 feet.

Equipment: A work platform, 400 beef trolleys, and 140 feet of dressing rail are used for 3.78 machine-hours each, for a total of 11.34 machine-hours.

Weighing, pegging neck.--The weigher first inserts a wooden peg into the neck of each carcass side. He then manually pushes the sides onto the overhead track of the dial scale (an average distance of 10 feet), dries his hands on a towel, records the carcass weight on a tally sheet, stamps and tags each side and pushes the sides off the scale (average distance of 5 feet).

The majority of the weigher's time is spent moving carcasses into the chill room. This work is not considered a part of the line operations. For purposes of this study, the line operations end after the carcass sides are moved off the scales.

Equipment: A dial scale, 400 beef trolleys and 140 feet of dressing rail; used for 1.59 machine-hours each. The total machine-hours are 4.77.

Labor Requirements

The labor required to dress 100 cattle 4.14 hours (24 head per hour) is shown in table 1. The elapsed time for each operation

is the same as the productive time except for flooring and rumping, backing, and eviscerating. The total elapsed time for flooring for all three beds is 9.57 hours per 300 carcasses. The elapsed time per 100 carcasses is therefore 3.19 hours. The elapsed time for the rumping, backing, eviscerating operation is 1.14 hours, which makes at the pace-setting operation. Job-regulated wait time occurs during all other operations. The eviscerator also has wait time because his job requires only 2.13 hours. However, unproductive labor for this worker, and the workers performing the bruise-trimming and weighing operations, is eliminated by assigning them to other plant work between cycles of dressing line work. The waiting periods in other operations are not long enough for the workers to be assigned to other work in the plant without causing delays.

Supporting Operations

Supporting operations in the three-bed system include head workup (washing, dehorning, and trimming heads) and transporting viscera. Supporting operations for many plants using the three-bed system also include pluck (heart, lungs, and trachea) and paunch workup (separating and cleaning the paunch). Because this work is not done on killing floors using the powered system it is not included in the analysis of the three-bed system. It is suggested, however, that plants using the three-bed system perform this work on the killing floor. Space for these operations is provided in the layout described in this report.

Head workup.--Two workers perform this operation, which includes removing heads from carcasses, carrying them to the head workup area, washing (flushing) and dehorning the heads, dropping the tongues, and trimming head and cheek meat. Heads are removed from carcasses while they are on the bleeding rail. It is important that heads be removed from carcasses at a rate comparable to the speed of the bleeding, head-skinning operation to prevent delays in dressing-line work.

One worker, located near a head flush cabinet and head inspection truck walks to the bleeding pit (average distance 10 feet), severs the trachea and esophagus, and carries each head to the cabinet. He places the heads on hooks in the cabinet, flushes each head and dehorn it with a handsaw or cleaver, depending on the size of the horns. He then places the head on the inspection truck. When an average of four heads has been assembled, the worker drops the tongues (fig. 4). This involves cutting the hyoid bones, removing the tonsils, and loosening the tongue so that it hangs by forejaws. After he completes work on 12 heads, the worker pushes the truck to the head inspection area (average distance



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Figure 4.--Two heads with the tongues dropped hang on a head inspection truck.

20 feet) and returns to his work area. He is supplied with empty inspection trucks by the second worker.

After the 12 heads have been inspected, the second worker pushes the inspection truck to his work area (average round-trip distance 50 feet). He removes the heads one at a time from the truck and places them on the head workup table. He removes head and cheek meat, tongues, and lips, separates the jaws, and throws the head bones into a chute. The head and cheek meat are placed in a tub truck. He washes 12 tongues at a time, carries two at a time to the offal truck (average distance 5 feet), hangs the tongues on the truck and returns to his work area. He then pushes the empty inspection truck to the head flushing work area (average distance 10 feet), and returns to his work area.

Both workers wash their hands and tools.

Equipment: A head flush cabinet is used for 3.92 machine-hours and a head workup table for 3.88 machine-hours; two head inspection trucks, a sterilizing lavatory, and two offal trucks are used for 7.80 machine-hours each. The total machine-hours are 31.20.

Transporting viscera.--One worker performs the operation. He pushes the paunch truck loaded with viscera from the eviscerating work area to the pluck table (average

distance 25 feet); places the heart, liver, lungs, windpipe, and spleen on the pluck table; and pushes the paunch truck 20 feet to the paunch table lift. He then dumps the viscera onto the lift, pushes the empty truck (average distance 6 feet) to the truck sterilizing area and rinses the truck. The worker then pushes the paunch truck back to the eviscerating area (average distance 30 feet). Periodically during the day, the worker pushes an offal truck containing hearts, livers, tongues, and spleens (average distance 30 feet) and a tub truck of head and cheek meat (average distance 40 feet) off the killing floor. He also washes the floor of the supporting operations work area; transports drums of offal (udders, pizzles, tripe, trimmings) on a drum truck off the floor (average distance 45 feet); and washes his hands and tools.

The equipment used consists of two tub trucks, a paunch truck, a drum truck, and a sterilizing lavatory for 2.08 machine-hours each, for a total of 8.32 machine-hours.

Costs

Total labor and equipment costs per 100 cattle for killing-floor operations in the three-bed system are in table 2.

TABLE 2.--Three-bed killing-floor system: Labor and equipment requirements for performing killing-floor operations at the rate of 75 head per hour

[Based on dressed beef carcasses weighing 500-700 pounds]

Operation	Requirements		Costs		
	Labor	Equipment	Labor	Equipment	Total
	Man-hours	Machine-hours	Dollar	Dollar	Dollar
Dressing-line operations:					
Productive labor, by operations:					
Driving, immobilizing, dry-landing.....	3.49	14.37	0.60	4.44	5.04
Bleeding, skinning head.....	2.46	9.84	0.70	.30	1.00
Flooring.....	15.95	15.50	43.80	.84	44.64
Rumping, backing, eviscerating.....	10.41	11.40	28.63	1.41	30.04
Dropping hide.....	3.72	7.62	10.23	.11	10.34
Sawing carcass, scribing.....	3.30	19.80	9.08	2.18	11.26
Bruise trimming.....	2.11	6.33	5.80	.08	5.88
Washing.....	3.59	14.36	9.87	1.80	11.67
Shrouding.....	3.78	11.34	10.40	.18	10.58
Weighing, pegging neck.....	1.59	4.77	4.37	.39	4.76
Subtotal.....	50.40	115.33	138.60	11.64	150.24
Unproductive labor, all operations.....	9.25	0	25.44	0	25.44
Subtotal.....	59.65	115.33	164.04	11.64	175.68
Supporting operations:					
Productive labor:					
Head workup.....	7.80	31.20	21.45	.49	21.94
Transporting viscera.....	2.08	8.32	5.72	.22	5.94
Subtotal.....	9.88	39.52	27.17	.71	27.88
Total.....	69.53	154.85	191.21	12.35	203.56

GRAVITY ON-THE-RAIL SYSTEM

Dressing-line work for the gravity system consists of 12 operations, each requiring 1 worker. Supporting work, like that of the three-bed system, consists of two operations and requires three workers. Labor requirements for each element of work in each operation are given in the appendix.

Dressing-Line Operations

The major movement of the carcass on this rail system is by gravity (fig. 5). The bleeding rail begins at a height of 17 feet above the floor in the dry-landing area and declines to 15 feet 8 inches through the second and third work areas. In the third work area, the carcass is transferred from the bleeding rail to a fixed transfer hoist, and the shackle is returned by gravity movement on the shackle return rail (a continuation of the bleeding rail) to the dry-landing area. In the fourth work area, a

worker inserts trolley hooks in the gams of the carcass and uses a second fixed transfer hoist to transfer the carcass to a swivel spreader suspended on the dressing rail. (Swivel spreaders have an attachment at the top which allows carcasses to be turned 180 degrees while work is being performed.) The dressing rail is 16 feet 4 inches high at its beginning and declines to 11 feet 4 inches at the ninth work area. Here the spreader is removed and the carcass is lowered to a spur rail 11 feet high where it is suspended by trolleys. The carcass is pushed by workers through the remaining work areas.

The spreader is returned on the spreader return rail (a continuation of the dressing rail) to the beginning of the dressing rail in the third work area. The spreader return rail is 11 feet high at its beginning, but slopes upward to 17½ feet behind the ninth work area. A powered conveyor here lifts the spreaders to this height, and they continue on the rail by gravity movement.

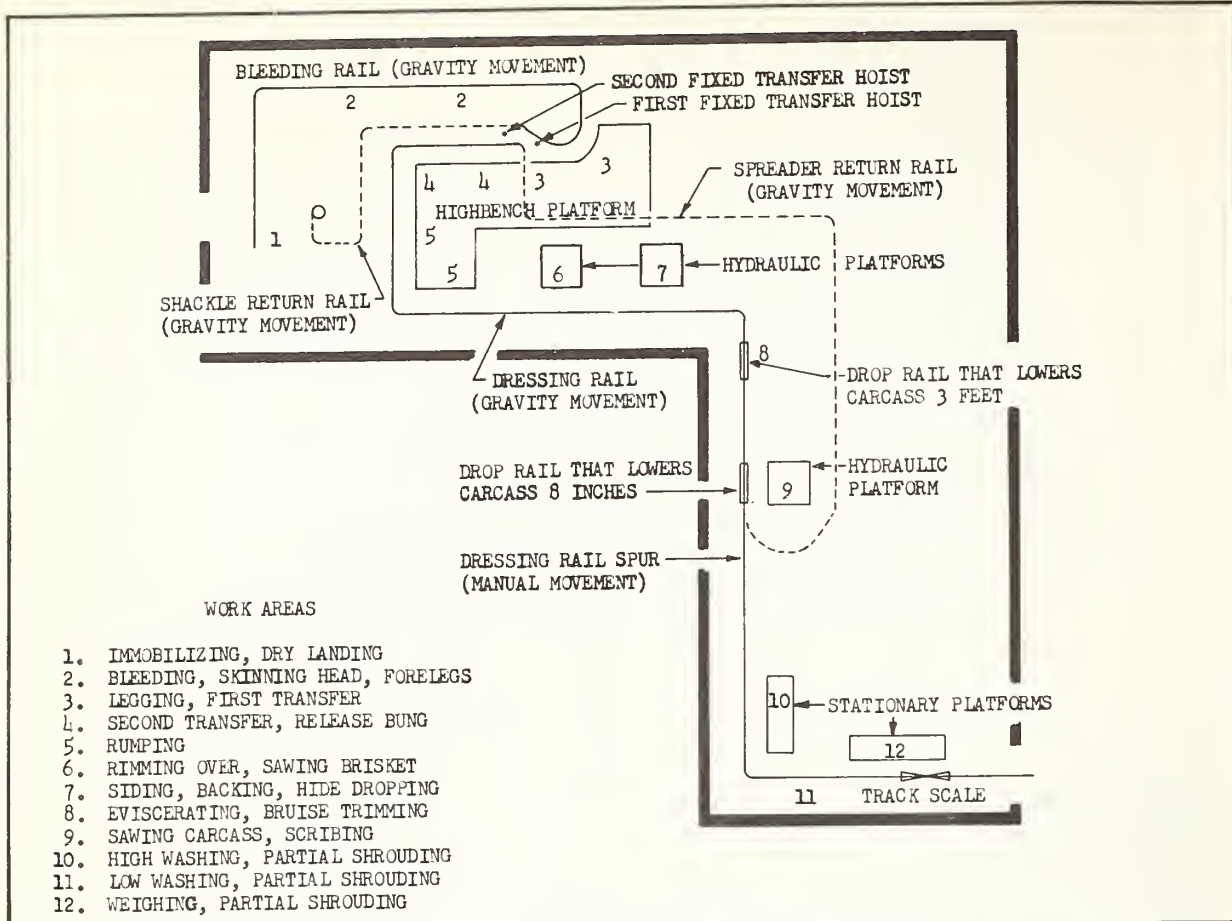


Figure 5.--Diagram of the rail system and dressing-line work areas on the gravity-on-the-rail killing floor.

The bleeding rail and the dressing rail are both equipped with mechanical stops; work stops and cushion stops alternate at 5-foot intervals. The dressing rail is also equipped with two pneumatic drop-rail sections. One drop rail lowers the carcass a maximum of 3 feet for eviscerating and the other about 8 inches to deposit the trolleys on the spur rail.

A shackle dropper (counterbalanced lowerator) at the end of the shackle return rail lowers shackles to the level of the worker on the floor in the dry-landing area.

One carcass at a time is processed through all operations in the gravity system.

The productive and unproductive labor for each operation are shown in table 3. In each operation that involves using a hand knife, the worker periodically washes his hands and tools in hot water.

Driving, immobilizing, dry-landing.--The work performed in this operation is the same as that in the three-bed system. Equipment: A shackle-return dropper, an automatic landing

hoist, a revolving stunning pen door, and 2 captive bolt stunners are used for 3.49 machine-hours each; 20 beef shackles are used for 2.28 machine-hours, and 80 feet of bleeding rail for 1.62 machine-hours. The total machine-hours are 17.86.

Bleeding, skinning head, forelegs.--The worker performs the bleeding and skinning head work in the same manner as in the three-bed system. He then rips the hide along the inside of the forelegs and around the hooves, skins the forelegs, removes them at the knee, and throws them into a foot chute.² The worker pulls the rail stops to allow carcasses to roll between work stations after each cycle.

The equipment consists of a sterilizing lavatory, 2 blood and water drains, 80 feet of bleeding rail, and 20 beef shackles for 4.08 machine-hours each for a total of 16.32 machine-hours.

² Leg and foot are used interchangeably in the industry in referring to that part of the front or hind legs cut off with a saw or hand knife.

TABLE 3.--Gravity on-the-rail killing-floor system: Crew organization and labor requirements to dress 100 cattle in 4.14 hours (24 head per hour)

[Based on dressed beef carcasses weighing 500-700 pounds.]

Operation	Crew size	Labor requirements		
		Productive	Unproductive ¹	Total
	Number	Man-hours	Man-hours	Man-hours
Driving, immobilizing, dry-landing.....	1	3.49	0.65	4.14
Bleeding, skinning head, forelegs.....	1	4.08	.06	4.14
Legging, first transfer.....	1	3.86	.28	4.14
Second transfer, release bung.....	1	3.65	.49	4.14
Rumping.....	1	3.36	.78	4.14
Rimming over, sawing brisket.....	1	4.10	.04	4.14
Siding, backing, hide dropping.....	1	4.11	.03	4.14
Eviscerating, bruise trimming.....	1	4.14	0	4.14
Sawing carcass, scribing.....	1	2.98	1.16	4.14
High washing, partial shrouding.....	1	2.76	1.38	4.14
Low washing, partial shrouding, pegging neck	1	2.95	² 0	2.95
Weighing, partial shrouding.....	1	2.36	² 0	2.36
Total.....	12	41.84	4.87	46.71

¹ Job-regulated wait time.

² No unproductive labor is incurred because the worker performing the operation is assigned to other plant work between cycles of work on the dressing line.

Legging, first transfer.--Work performed in this operation includes dropping the bung and making crotch opening, slitting the tail hide, skinning and removing the hind legs at the hock, skinning the flank area, and transferring the carcass from the bleeding rail to a fixed hoist.

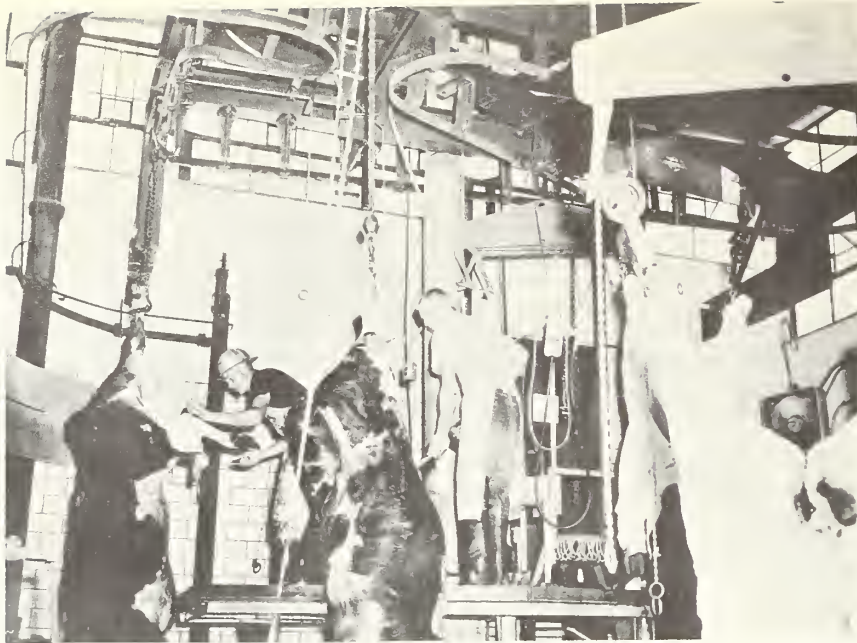
The worker is stationed on a highbench metal platform (see work areas No. 3, fig. 5).

In his first work area, he uses a hand knife to cut through the hide around the bung and make the crotch opening, and then cuts the hide along the inside of the tail, and frees the tail tip. Still using a hand knife, the worker skins the free hind leg (fig. 6), makes the gam cut, and skins the flank area below the leg. He then uses a portable, air-driven saw to remove the leg at the hock, and throws the leg into a foot chute. The worker then releases the work stop to move the carcass to his second work area, where the fixed transfer hoist is located. Transferring is accomplished by first inserting the fixed hoist hook into the gam opening of the skinned leg and hoisting the carcass until there is slack in the shackle chain supporting the other hind leg. This shift of carcass weight to the fixed hoist allows the worker to remove the shackle chain, freeing the other hind leg for skinning and removal. He also releases a rail work stop on the bleeding rail to allow the shackle to return to the

dry-landing area. He removes this hind leg, skins the flank area below it, and makes the gam cut. He then releases a cushion stop to allow the next carcass to move to his work station.

Equipment: 80 feet of bleeding rail and 20 beef shackles are used for 2.40 machine-hours each, and 2 blood and water drains, a transfer hoist, a sterilizing lavatory, a portable air-driven saw, and a highbench platform are used for 3.86 machine-hours each. The total machine-hours are 24.10.

Second transfer, release bung.--At the beginning of this operation the carcass is suspended by one hind leg on the first transfer hoist. The worker stands on the highbench platform (see work areas No. 4, fig. 5). He inserts the hook of the second transfer hoist into the gam of the free leg, and manipulates the hoist to adjust the legs of the carcass to the same level. He then inserts trolley hooks into the gams of both legs. The trolleys are hung on a spreader which is suspended on the dressing rail. He removes the hoist hooks to allow the full weight of the carcass to rest on the spreader (figs. 7, 8). He then releases the work stop on the dressing rail to move the carcass to his next work area. Here he uses a hand knife to open the belly hide down to the brisket area. He then ties off the bladder with string, and cuts the bung loose and ties it off.



BN-19394

Figure 6.--A worker standing on a highbench platform skins the free hind leg of a carcass at the legging, first transfer work station in the gravity-on-the-rail system. The carcass is hanging by a shackle on the bleeding rail.



BN-18387

Figure 7.--Closeup view of a worker transferring a carcass from a hoist to a spreader. Trolley hooks have been inserted in both legs; the hoist hook has not yet been removed from the left leg.

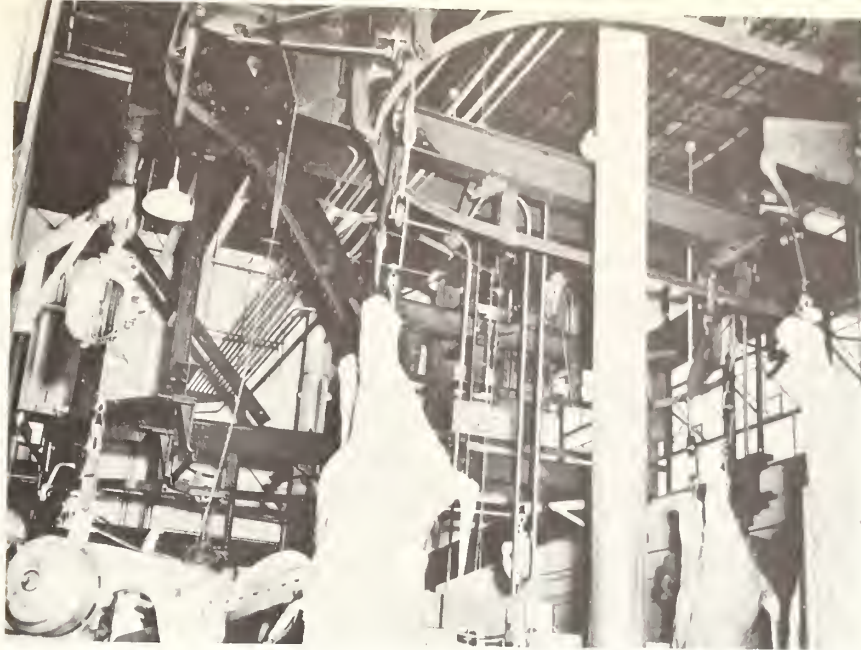
He uses a mechanical knife to skin both sides of the belly incision and the back of each hind leg. The worker also opens the aitchbone and then releases the stop for the carcass to move to a cushion stop.

The equipment used: A transfer hoist, 20 spreader trolleys, 400 standard beef trolleys,

20 beef spreaders, a gravity rail system, a sterilizing lavatory, and a highbench platform for 3.65 machine-hours each; a mechanical knife for 1.34 machine-hours, for a total of 26.89 machine-hours.

Rumping.--Besides skinning the rump with a mechanical knife, the worker performing this operation pulls the hide from the tail of the carcass with a hydraulic puller. This worker is also stationed on the highbench platform (see work areas numbered 5, fig. 5). The worker first releases a cushion stop to allow a carcass to move to the rumping work area. He positions the carcass and skins the rump. He then releases the work stop for the carcass to move to the tail-pulling work area. This area is equipped with a hydraulic tail puller operated by a foot valve (fig. 9). The worker takes a tail clamp from the bench, hangs the hook of the clamp on the spreader, locks the clamp to the tail tip, wraps the tail switch around the puller, and presses the foot valve. The puller strips the hide from the tail. The worker then removes the hide from the puller, severs the tail tip, and replaces the tail clamp on the bench.

Equipment: A sterilizing lavatory, 20 beef spreaders a highbench platform, 20 spreader trolleys, 400 standard beef trolleys, tail clamp and hydraulic puller, and a gravity dressing-rail system are used for 3.36 machine-hours each; a mechanical knife is used for 2.21



BN-19386

Figure 8.--Carcasses suspended from dressing rail on standard beef trolleys and swivel spreaders. Mechanical rail stops are at the top of the rail in foreground.



BN-19389

Figure 9.--A hydraulic puller and tail clamp, used in the gravity on-the-rail and powered on-the-rail systems.

machine-hours. The total machine-hours are 25.73.

Rimming over, sawing brisket.-- This operation includes making an incision in the carcass from the brisket to the neck area, partial skinning (rimming over) of each side of the incision with a hand knife, skinning the hide from around both forelegs and from rosette, sawing the brisket, and making an incision to clear the gullet (cut it loose from the neck area).

Each carcass is transported an average distance of 10 feet through the operation. A hydraulic platform raises the worker to the most convenient working height.

The worker uses a hand knife to open the breast hide down to the neck area and to start the rimover work on the brisket. The rimover work on both sides of the brisket is completed with a mechanical knife. The worker then switches back to the hand knife to skin around both forelegs. A brisket saw is used to saw the brisket. Left and right rosettes are next skinned with a hand knife and the weasand is separated. After each cycle of work, the worker releases a cushion and a work stop for carcasses to move to and from his work station.

Equipment: A sterilizing lavatory, 20 beef spreaders, a gravity rail system, 20 spreader trolleys, 400 standard beef trolleys, a hydraulic platform, and a brisket saw are used for 4.10 machine-hours each; a mechanical knife is used for 1.60 machine-hours. The total machine-hours are 30.30.

Siding, backing, hide dropping.--One worker, using a hydraulic platform to obtain proper working height, performs the operation. Each carcass is transported a total distance of 10 feet through the working area.

The worker first ties the weasand and then skins the neck area with a hand knife. Next he skins the sides and back with a mechanical knife, and the hide drops into the chute. He releases rail stops for carcasses to move in and out of his work area.

Equipment: A sterilizing lavatory, 20 spreaders, 20 trolley spreaders, 400 standard beef trolleys, a hydraulic platform, and a gravity rail system are used for 4.11 machine-hours each. A mechanical knife is used for 2.31 machine-hours. The total machine-hours are 26.97.

Eviscerating, bruise trimming.--A special drop-rail section is used for eviscerating to allow the carcass to be lowered to the level of a worker standing on the floor to eviscerate into a paunch truck. This operation is the limiting factor to the production capacity on this dressing line. Other operations may be broken into finer segments of work and additional workers assigned to increase production, but it is difficult to increase the production rate of eviscerating. Studies indicate that about 35 cattle per hour of the assumed weight class would be the limit when the drop rail section is used.

The eviscerator first positions a carcass on the drop rail section to lower it into working position. He eviscerates into a paunch truck,

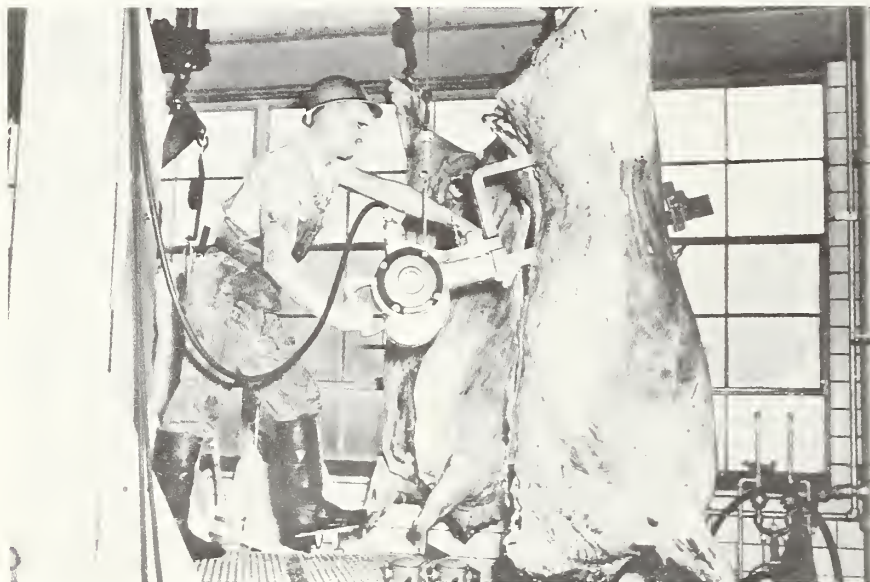
removes the pluck, and place it on the truck tray. He also removes the udder or pizzle. After the carcass is raised back to rail level the worker trims bruises from the carcass and then releases the rail stop to allow gravity flow to the next station. The worker periodically cleans up the working area.

Equipment: A sterilizing lavatory, 20 beef spreaders, 20 spreader trolleys, 400 standard beef trolleys, a pneumatic drop-rail section, a paunch truck, and a gravity rail system are used for 4.14 machine-hours each, for a total of 28.98 machine-hours.

Sawing carcass, scribing.--The worker saws the carcass into sides (fig. 10) and scribes the sides in the same manner as in the three-bed system. After this work is completed, the drop-rail section in the dressing rail (fig. 5, work area No. 9) is lowered to deposit the trolleys onto the dressing-rail spur, while the spreader continues on the spreader return rail to the second transfer station. The worker pushes the carcass to the next work station.

The equipment used in the operation consists of 20 spreaders, 20 spreader trolleys, and a pneumatic drop-rail section for 2.70 machine-hours each. A beef carcass saw, a sterilizing lavatory, a hydraulic platform, 400 standard beef trolleys, and a 160-foot gravity dressing rail system are used for 2.98 machine-hours each. The total machine-hours are 23.

High washing, partial shrouding.--In this operation, the worker stands on a stationary platform about 4 feet high. After he pushes the



BN-19390

Figure 10.--Sawing a carcass into sides from a hydraulic platform. In the gravity on-the-rail and powered on-the-rail systems, the carcass is suspended on the rail by trolleys attached to a spreader. In the three-bed system, the carcass hangs on the rail on trolleys which are spread apart by a pneumatic device.

two sides of a carcass to his work area, he positions the sides, washes the rump area and hind legs of the sides, and pins a shroud on the round of each side. Intermittently throughout the day, the worker obtains supplies of pins and shrouds and places them in containers on the platform. Before pushing the carcass toward the next work area, he gives a final spray of water to the portion of the hind legs not covered by the shroud. He pushes the sides an average distance of 15 feet through his work area.

Equipment: A gravity rail system, 400 standard beef trolleys, and a work platform are used for 2.76 machine-hours each, and a hydraulic cattle wash unit for 1.54 machine-hours, for a total of 9.82 machine-hours.

Low washing, partial shrouding, pegging neck.--This worker, stationed on the floor, completes the washing of the two sides, pegs the neck, and pins the shroud along the backbone, brisket, and belly of one side.

The equipment used in the operation consists of a gravity dressing rail system and 400 standard beef trolleys for 2.95 machine-hours each, and a cattle wash pump for 1.27 machine-hours, for a total of 7.17 machine-hours.

Weighing, partial shrouding.--The weigher completes shrouding of the remaining carcass side and then pushes both sides an average distance of 5 feet onto the overhead track scales. He steps over to the dial, dries his hands, and records the weight of the carcass on a tally sheet. He then stamps and tags the carcass sides.

Equipment: A gravity dressing rail system, 400 beef trolleys, a stationary work platform, and a dial scale are used for 2.36 machine-hours each--a total of 9.44 machine-hours.

The weigher and the worker who perform the low washing operation both move carcasses into the chill room, but time spent in this work is not charged to dressing-line operations. In this study, the work cycle ends after the weigher moves the sides off the overhead track scales.

Labor Requirements

The pace-setting operation in this system is the eviscerating operation. Relatively short periods of job-regulated wait time occur in the first seven operations. In the last four operations, wait periods are longer than 1 hour per 100 cattle, but the workers assigned to the low washing, partial shrouding, and weighing operations do other work in the plant during their waiting periods.

Labor requirements per 100 cattle for performing dressing-line operations in the gravity on-the-rail system are shown in table 3.

Supporting Operations

Two operations--head workup and transporting viscera--are performed in almost the same manner with the same equipment as described for the three-bed system. Three workers perform the operations. The main differences occur in transport distances.

Head workup.--The first worker performs the tasks of obtaining heads, washing and dehorning them, and dropping the tongues. He walks an average distance of 15 feet from his work area to the bleeding pit.

The second worker pushes empty head inspection trucks to the head washing area (average transport distance 10 feet) and full trucks (average distance 15 feet) to the inspection area. After heads have been inspected, he moves the truck to the head workup table (average distance 10 feet), trims the head and cheek meat, and performs the other tasks of head workup in the same manner as described for the three-bed system.

Equipment: A head flush cabinet for 3.95 machine-hours, a head workup table for 3.89 machine-hours, a sterilizing lavatory, two head-inspection trucks and two offal trucks are used for 7.84 machine-hours each, for a total of 31.36 machine-hours.

Transporting viscera.--This work is slightly different from that performed in the three-bed system.

The worker pushes the paunch truck loaded with viscera from the eviscerating work station to the paunch table lift (average distance 15 feet); carries the heart, liver, lungs, and windpipe to the pluck table (average distance 5 feet), and places them on the table; returns to the truck and dumps the viscera onto the paunch lift. He then pushes the truck to the truck sterilizing area (average distance 6 feet), rinses it, and returns it to the eviscerating work station (average distance 20 feet).

He moves a 30-gallon drum of udders, pizzles, trimmings, and tripe from the paunch table area (average distance 5 feet) and dumps it into the offal chute twice per 100 carcasses. He also transports edible offal (liver, hearts, spleens, tongues, and cheek meat) via offal and tub truck, from the killing floor (average distance 35 feet). Periodically throughout the day he washes the floor of the supporting operations work area.

The equipment requirements are two tub trucks, a drum truck, a sterilizing lavatory and a paunch truck for 1.74 machine-hours each, for a total of 6.96 machine-hours.

Costs

Total labor and equipment costs per 100 cattle for killing-floor operations in the gravity on-the-rail system are shown in table 4.

TABLE 4.--Gravity on-the-rail system: Labor and equipment requirements and costs per 100 cattle for performing killing-floor operations at the rate of 24 head per hour

[Based on dressed beef carcasses weighing 500-700 pounds]

Operation	Requirements		Costs		
	Labor	Equipment	Labor	Equipment	Total
	<u>Man-hours</u>	<u>Machine-hours</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
Dressing-line operations:					
Productive labor, by operations:					
Driving, immobilizing, dry landing.....	3.49	17.86	9.60	4.76	14.36
Bleeding, skinning head, forelegs.....	4.08	16.32	11.22	.19	11.41
Legging, first transfer.....	3.86	24.10	10.62	.78	11.40
Second transfer, release bung.....	3.65	26.89	10.03	1.21	11.24
Rumping.....	3.36	25.73	9.24	1.22	10.46
Rimming over, sawing brisket.....	4.10	30.30	11.28	2.58	13.86
Siding, backing, hide dropping.....	4.11	26.97	11.30	1.39	12.69
Eviscerating, bruise trimming.....	4.14	28.98	11.38	.69	12.07
Sawing carcass, scribing.....	2.98	23.00	8.20	2.43	10.63
High washing, partial shrouding.....	2.76	9.82	7.59	1.17	8.76
Low washing, partial shrouding, pegging neck.....	2.95	7.17	8.11	.89	9.00
Weighing, partial shrouding.....	2.36	9.44	6.49	.58	7.07
Subtotal.....	41.84	246.58	115.06	17.89	132.95
Unproductive labor, all operations.....	4.87	0	13.39	0	13.39
Subtotal.....	46.71	246.58	128.45	17.89	146.34
Supporting operations:					
Productive labor:					
Head workup.....	7.84	31.36	21.56	.49	22.05
Transporting viscera.....	1.74	6.96	4.79	.15	4.94
Subtotal.....	9.58	38.32	26.35	.64	26.99
Total.....	56.29	284.90	154.80	18.53	173.33

POWERED ON-THE-RAIL SYSTEM

Dressing-line work in the powered on-the-rail system requires one worker for each of 12 operations. Three workers are required for the two supporting operations. Labor requirements for each element of work in each operation are given in the appendix.

Dressing-Line Operations

A major difference between this system and the gravity system is that carcasses are moved on the dressing rail by intermittent powered drive (fig. 11). Other major differences are in equipment used to aid in work on the carcass. The powered system employs six hydraulic platforms and a moving-top viscera inspection table (the table top is

stationary or can be operated as a conveyor, as required). Carcasses are processed one at a time through all operations.

The bleeding rail is similar to that in the gravity system. Carcasses are moved by gravity, and the rail is equipped with work stops and cushion stops. Other similarities are: Carcasses are moved from the bleeding rail to the dressing rail by means of two fixed transfer hoists; shackles are returned to the dry-landing area by gravity on a shackle-return rail equipped with a shackle dropper; carcasses are suspended on the dressing rail by beef trolleys on swivel spreaders; and the dressing rail is equipped with two drop-rail sections.

The hydraulic chain drive that moves carcasses along the dressing rail is controlled by a timing device. Each worker must complete his operation within a preset time cycle,

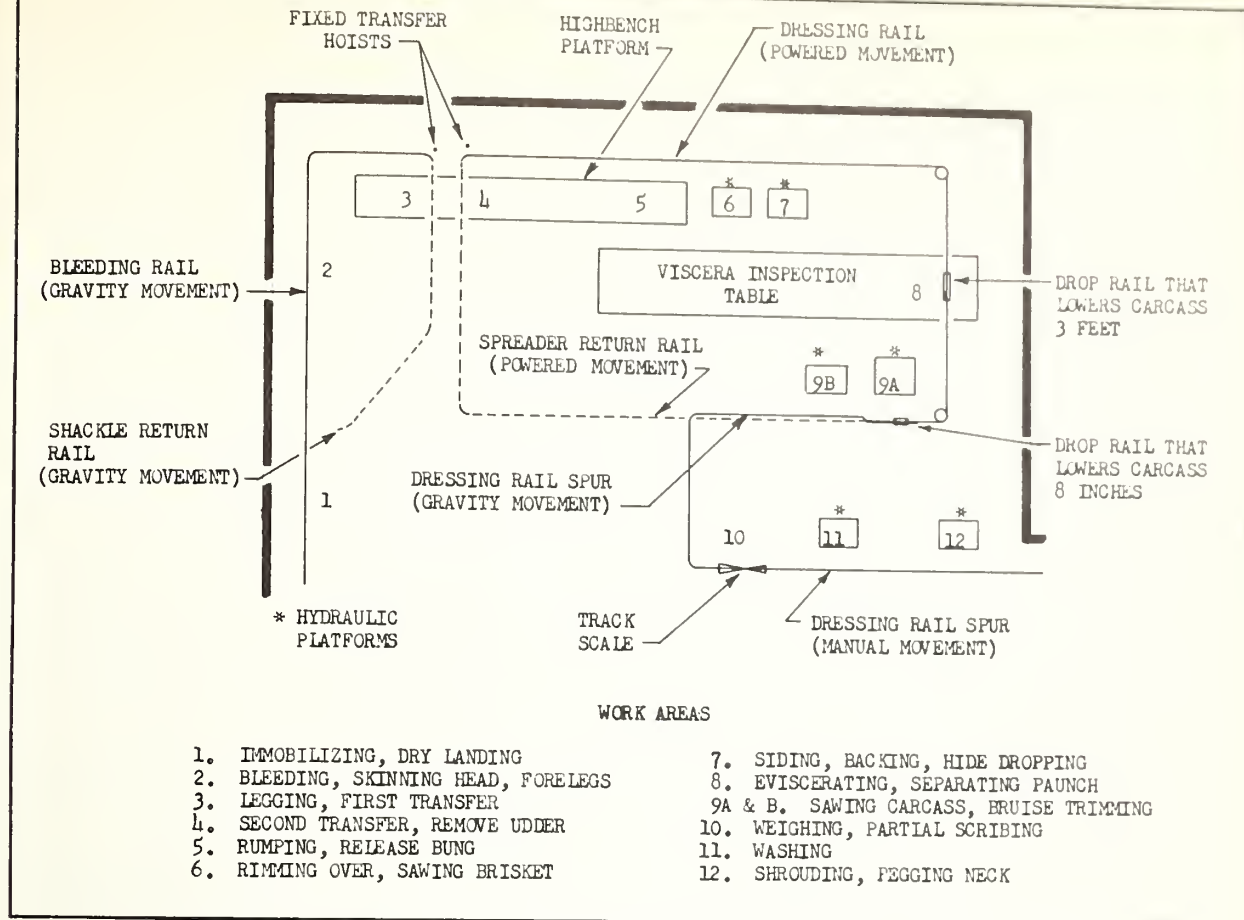


Figure 11.--Diagram of the rail system and dressing-line work areas on the powered on-the-rail killing floor.

because the carcass is automatically moved to the next work station at the end of the cycle. In this analysis, for a dressing rate of 24 head per hour, the cycle is set to move carcasses from one work station to the next every 2.48 minutes.

The viscera inspection table is used to convey viscera from the eviscerating work station (fig. 11, work area No. 8) to the inspection area, and to appropriate gravity chutes. Movement of the tabletop is controlled by the inspector. The eviscerator stands on the table, lowers the carcass by means of the drop rail, and removes the viscera onto the table.

After the carcass is sawed into sides (fig. 11, work area 9A), the sides are transferred from the spreader and powered rail, by means of a drop rail, to a nonpowered spur rail, where they are suspended by trolleys. The carcass sides are moved by gravity on the spur rail to the weighing area (fig. 11, work area No. 10); part of the spur rail is equipped with a decline conveyor to aid in the movement. Workers

push the sides on the spur rail through the remaining work areas.

Much of the work performed on the carcass is done in the same way as in the gravity system. In each operation that involves using a hand knife, the worker periodically washes his hands and tools in hot water.

The crew organization and productive and unproductive labor are shown in table 5.

Driving, immobilizing, dry landing.--The work performed is the same as with the gravity system, and the equipment requirements are the same.

Bleeding, skinning head, forelegs.--This operation is performed in the same manner as in the gravity system, and the labor and equipment requirements are the same.

Legging, first transfer.--This operation is performed in the same manner as in the gravity on-the-rail system. Equipment and layout differences cause a slight difference in labor requirements. The work station is an area of a metal highbench platform (fig. 11,

TABLE 5.--Powered on-the-rail killing-floor system: Crew organization and labor requirements to dress 100 cattle in 4.14 hours (24 head per hour)

[Based on dressed beef carcasses weighing 500-700 pounds]

Operation	Crew size	Labor requirements		
		Productive	Unproductive ¹	Total
	Number	Man-hours	Man-hours	Man-hours
Driving, immobilizing, dry landing.....	1	3.49	0.65	4.14
Bleeding, skinning head, forelegs.....	1	4.08	.06	4.14
Legging, first transfer.....	1	4.12	.02	4.14
Second transfer, remove udder.....	1	3.83	.31	4.14
Rumping, release bung.....	1	3.70	.44	4.14
Rimming over, sawing brisket.....	1	3.93	.21	4.14
Siding, backing, hide dropping.....	1	3.94	.20	4.14
Eviscerating, separating paunch.....	1	² 2.68	0	² 2.68
Sawing carcass, bruise trimming.....	1	3.66	.48	4.14
Weighing, partial shrouding.....	1	2.05	³ 0	2.05
Washing.....	1	3.44	.70	4.14
Shrouding, pegging neck.....	1	3.90	.24	4.14
Total.....	12	42.82	3.31	46.13

¹ Job-regulated wait time caused by irregular flow of work between operations.

² Excludes 1.46 man-hours devoted to separating paunch.

³ No unproductive labor is incurred because the worker performs jobs in supporting operations for 2.09 man-hours.

work area No. 3); other areas of the platform are used as work stations for the next two operations. At the completion of the work cycle, the carcass has been removed from the bleeding rail and is suspended by one leg on the first transfer hoist.

The equipment consists of 80 feet of bleeding rail, and 20 beef shackles used for 2.66 machine-hours each; two blood and water drains, a transfer hoist, a portable air-driven saw, a highbench platform, and a sterilizing lavatory used for 4.12 machine-hours each. The total machine-hours are 25.92.

Second transfer, remove udder.--The worker transfers the carcass to a spreader on the dressing rail, by means of the second transfer hoist. The transfer is made in the same way as that described for the gravity system. The worker then makes a belly incision down to the brisket, removes the udder or pizzle, ties off the bladder, skins the belly on both sides of the incision, skins the back of the hind legs, and opens the aitchbone.

Equipment: A sterilizing lavatory, a transfer hoist, powered rail system, highbench platform, 20 beef spreaders, and 20 spreader trolleys are used for 3.83 machine-hours each, 400 standard beef trolleys for 3.50 machine-hours, and a mechanical knife for

1.34 machine-hours--a total of 27.82 machine-hours.

Rumping, release bung.--The worker skins the rump and pulls the skin from the carcass tail with a hydraulic tail puller; this is done in the same way as in the gravity system. The worker also releases and ties off the bung.

Equipment: A sterilizing lavatory, a highbench platform, 20 beef spreaders, 20 spreader trolleys, 400 standard beef trolleys, a powered rail system, and tail clamp and hydraulic tail puller are used for 3.70 machine-hours each, and a mechanical knife for 2.21 machine-hours--a total of 28.11 machine-hours.

Rimming over, sawing brisket.--The work performed on the carcass in this operation is the same as that in the gravity system.

Labor requirements for the operation are less in the powered system because the worker does not have to pull rail stops to move the carcass on the dressing rail.

The equipment consists of a sterilizing lavatory, 20 beef spreaders, 20 spreader trolleys, 400 standard beef trolleys, a hydraulic platform with sterilizer, a brisket saw, and a powered rail system used for 3.93 machine-hours each; and a mechanical knife used for 1.60 machine-hours, for a total of 29.11 machine-hours.

Siding, backing, hide dropping.--The work performed on the carcass in this operation is the same as that in the gravity system.

Labor requirements for the operation are less in the powered system because the worker does not have to pull rail stops to move the carcass on the dressing rail.

Equipment: A sterilizing lavatory, 20 beef spreaders, 20 spreader trolleys, 400 standard beef trolleys, a hydraulic platform, and a powered rail system are used for 3.94 machine-hours each; a mechanical knife is used for 2.21 machine-hours. The total machine-hours are 25.85.

Eviscerating, separating paunch.--The worker stands on the viscera inspection table and lowers the drop-rail section to position the carcass at proper working height and removes the viscera from the carcass onto the table. When the viscera is on the table, the worker separates the paunch, which involves tying off and severing the paunch, tying off and severing a section of the bung and bladder, and tying off and removing a section of the gullet. When this work is completed, the worker raises the drop rail to bring the carcass back to rail level.

Separating paunch is work not performed as part of the dressing-line operations in either the three-bed or gravity systems. The labor and equipment requirements for this work have therefore been excluded from dressing-line requirements for this system. A portion of the cost of the viscera-inspection table is allocated to the separating paunch work.

The equipment used and requirements for eviscerating only are: A sterilizing lavatory, 20 beef spreaders, 20 spreader trolleys, an equipment wash platform, a moving-top viscera-inspection table, a pneumatic drop-rail section, 400 standard beef trolleys, and a powered rail system used for 2.68 machine-hours each, for a total of 21.44 machine-hours.

Sawing carcass, bruise trimming.--Two hydraulic platforms (fig. 11, work areas Nos. 9A and 9B) are used in this operation--one for sawing carcasses and partial scribing, and the other for trimming bruises. The latter platform is also used by the inspector to make rail inspections.

The worker steps on the first hydraulic platform, raises it to proper working level, cuts the tail muscle of the carcass, and puts the carcass saw in position. He then saws the carcass in half and lowers the drop-rail section to deposit the sides on trolleys on the dressing rail spur. He cuts the chine bones on each side. The spreader continues on the spreader return rail (a continuation of the dressing rail) to the beginning of the dressing rail in the fourth work area. The worker then steps on the other hydraulic platform, raises it to working level and trims the carcass sides for bruises. He releases work stops at the sawing and trimming work areas.

The equipment used in the operation consists of a sterilizing lavatory, 400 standard beef trolleys, a hydraulic platform, a beef carcass saw, a mechanical scribe saw, a pneumatic drop-rail section, and a hydraulic platform for 3.66 machine-hours each; 20 beef spreaders, 20 spreader trolleys, 115 feet of dressing rail, and a powered rail system for 1.99 machine-hours each; for a total of 33.58 machine-hours.

Weighing, partial scribing.--In this operation, the worker first uses a hand scribe saw to pound the back of the shoulder flat on each carcass side to finish the scribing work. He then pushes the sides onto the track scales, dries his hands, prints the weight ticket, records the weight on a tally sheet, and places the weight ticket on the carcass side. The worker pushes the sides to the washing station (average distance 8 feet), and walks back to the next carcass (average distance 15 feet) to complete his work cycle.

Equipment: 400 standard beef trolleys, dial scales with printing device, and 115 feet of dressing rail are used for 2.05 machine-hours each, for a total of 6.15 machine-hours.

Washing.--The worker stands on a hydraulic platform and washes both carcass sides (fig. 12). Plastic curtains on each side of the washing station prevent water splashing to other work areas. He then lowers the platform and pushes the carcass sides on the rail to the shrouding station.

Equipment: 400 standard beef trolleys, a hydraulic platform, a hydraulic cattle-wash unit, and 115 feet of dressing rail used for 3.44 machine-hours each, for a total of 13.76 machine-hours.

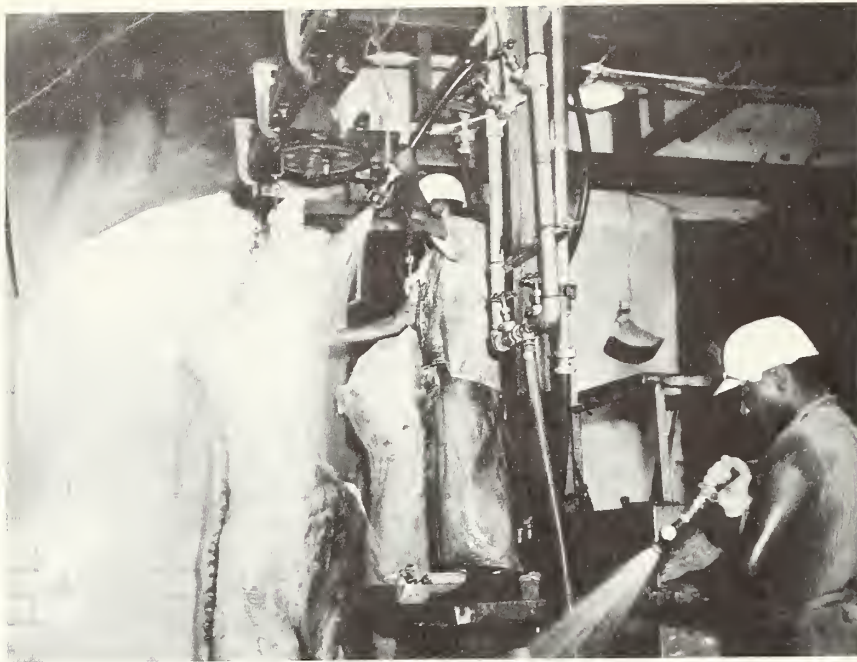
Shrouding, pegging neck.--Shrouding is also done from a hydraulic platform. Shroud cloths are kept in a container next to the platform.

The shrouder pegs the neck of each side, and also severs the tail from the carcass and throws it into the tail chute. He then shrouds each side, stamps the carcass, and moves the sides on the rail an average distance of 5 feet to await transport to the chill room. Twice daily, the shrouder performs the setup work of obtaining a supply of shrouds, pegs, and pins for his work area.

The equipment used in the operation consists of 400 standard beef trolleys, a hydraulic platform, and 115 feet of dressing rail for 3.90 machine-hours each, for a total of 11.70 machine-hours.

Labor Requirements

The labor requirements for 100 cattle for performing dressing-line operations in the powered on-the-rail system are shown in table 5.



BN-19388

Figure 12.--In the powered on-the-rail system a worker stands on a hydraulic platform to wash car-casses. Worker in foreground is washing the floor.

Eviscerating, separating paunch, which requires a total elapsed time of 4.14 man-hours, is the pace-setting operation. As explained earlier, the time required for separating paunch (1.46 man-hours) has been excluded from the labor requirements for this system.

The largest amount of job-regulated wait time occurs in the weighing operation (2.09 hours); the worker performing this operation would be assigned other work in the plant during his waiting periods on the line. The job-regulated wait time occurring in other operations ranges from 0.70 hour in the washing operation to 0.02 hour for the legging, first transfer operation. These wait periods are not long enough to permit the assignment of workers to other jobs in the plant.

Supporting Operations

Supporting operations in the powered system are generally the same as those in the three-bed and gravity systems. Two workers are assigned to head workup and one to transporting viscera.

Head workup.--The first worker walks from the head flush cabinet to the bleeding pit (average distance 5 feet), severs the head from the carcass and carries it to a dehorn table (average distance 10 feet). He removes horns with a portable, air-driven saw and trims any hide left around the base of the horns. He carries

the head to the head flush cabinet (average distance 5 feet), flushes it, places it on the head-inspection truck, removes the tonsils, and cuts the hyoid bones.

The second worker pushes an empty head inspection truck from his work area to the washing area (average distance 15 feet). He transports a loaded head inspection truck from the washing area to the inspection area (average distance 30 feet), and drops the tongues of each head. When the 12 heads have been inspected, he moves the truck to the trimming work area (average distance 25 feet), places the heads one at a time on the head workup table and trims each head in the same manner as in the gravity system. Head and cheek meat and tongues are thrown into a chute.

Equipment: A head flush cabinet, dehorn table, head workup table, and a portable, air-driven saw used for 4.13 machine-hours each; and two head inspection trucks, and a sterilizing lavatory used for 8.26 machine-hours, for a total of 33.04 machine-hours.

Transporting viscera.--The worker removes the heart, liver, lungs, windpipe, and spleen from the viscera inspection table and puts them into the pluck chute; guides the paunch as it reaches the end of the conveyor into the paunch chute; and washes the floor of supporting operations work areas intermittently during the day.

Equipment used in the operation consists of a sterilizing lavatory for 1.67 machine-hours and a moving-top viscera inspection table for 1.12 machine-hours, for a total of 2.79 machine-hours.

Costs

The total labor and equipment costs per 100 cattle (dressed weight 500 to 700 pounds) for killing-floor operations in the powered rail system are shown in table 6.

COMPARISON OF THREE SYSTEMS FOR PERFORMING KILLING-FLOOR OPERATIONS

Labor and equipment costs of the three killing-floor systems, for dressing-line operations and the supporting operations covered in

this study, are given in table 7. Costs per 100 head of the gravity system are \$30.23 less than those of the 3-bed system, and costs of the powered system are \$25.92 less than those of the 3-bed system. The variables entering into the comparisons are such that no significant differences between the two on-the-rail systems in long-range costs could be established. (Annual labor and equipment costs are \$86,665 for the gravity system and \$88,820 for the powered system).

Based on an annual volume of 50,000 head, labor and equipment costs of a plant using the powered system would be \$12,960 less per year than those of a plant using the 3-bed system. On the same basis, costs for the gravity system would be \$15,115 per year less than those of the 3-bed system.

Another advantage of the on-the-rail systems is that they require less floor space than the 3-bed system (see section on layouts).

TABLE 6.--Powered on-the-rail killing-floor system: Labor and equipment requirements and costs to dress 100 cattle at the rate of 24 head per hour

[Based on dressed beef carcasses weighing 500-700 pounds]

Operation	Requirements		Costs		
	Labor	Equipment	Labor	Equipment	Total
	Man-hours	Machine-hours	Dollars	Dollars	Dollars
Dressing-line operations:					
Productive labor, by operations:					
Driving, immobilizing, dry landing.....	3.49	17.86	9.60	4.76	14.36
Bleeding, skinning head, forelegs.....	4.08	16.32	11.22	.19	11.41
Legging, first transfer.....	4.12	25.92	11.33	.79	12.12
Second transfer, remove udder.....	3.83	27.82	10.53	1.73	12.26
Rumping, release bung.....	3.70	28.11	10.18	1.53	11.71
Rimming over, sawing brisket.....	3.93	29.11	10.81	3.05	13.86
Siding, backing, hide dropping.....	3.94	25.85	10.84	1.65	12.49
Eviscerating, separating paunch.....	2.68	21.44	7.37	2.25	9.62
Sawing carcass, bruise trimming.....	3.66	33.58	10.07	3.23	13.30
Weighing, partial scribing.....	2.05	6.15	5.64	.75	6.39
Washing.....	3.44	13.76	9.46	1.98	11.44
Shrouding, pegging neck.....	3.90	11.70	10.73	.38	11.11
Subtotal.....	42.82	257.62	117.78	22.29	140.07
Unproductive labor, all operations.....	3.31		9.10		9.10
Subtotal.....	46.13	257.62	126.88	22.29	149.17
Supporting operations:					
Productive labor:					
Head workup.....	8.26	33.04	22.72	.59	23.31
Transporting viscera.....	1.67	2.79	4.59	.57	5.16
Subtotal.....	9.93	35.83	27.31	1.16	28.47
Total.....	56.06	293.45	154.19	23.45	177.64

TABLE 7.--Cattle killing-floor systems: Labor and equipment requirements and costs, per 100 cattle, for performing dressing-line and selected supporting operations at 24 head per hour

[Based on dressed beef carcasses weighing from 500-700 pounds]

Systems	Requirements		Costs		
	Labor	Equipment	Labor	Equipment	Labor
	<u>Man-hours</u>	<u>Machine-hours</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
Three-bed:					
Dressing-line operations:					
Productive labor.....	50.40	115.33	138.60	11.64	150.24
Unproductive labor.....	9.25	0	25.44	0	25.44
Subtotal.....	59.65	115.33	164.04	11.64	175.68
Supporting operations:					
Productive labor.....	9.88	39.52	27.17	.71	27.88
Total.....	69.53	154.85	191.21	12.35	203.56
Gravity on-the-rail:					
Dressing-line operations:					
Productive labor.....	41.84	246.58	115.06	17.89	132.95
Unproductive labor.....	4.87	0	13.39	0	13.39
Subtotal.....	46.71	246.58	128.45	17.89	146.34
Supporting operations:					
Productive labor.....	9.58	38.32	26.35	.64	26.99
Total.....	56.29	284.90	154.80	18.53	173.33
Powered on-the-rail:					
Dressing-line operations:					
Productive labor.....	42.82	257.62	117.78	22.29	140.07
Unproductive labor.....	3.31	0	9.10	0	9.10
Subtotal.....	46.13	257.62	126.88	22.29	149.17
Supporting operations:					
Productive labor.....	9.93	35.83	27.31	1.16	28.47
Total.....	56.06	293.45	154.19	23.45	177.64

Total labor requirements for dressing-line operations, at 59.65 man-hours per 100 head for the 3-bed system, are 13 man-hours higher than those of the gravity system (46.71 man-hours) and the powered system (46.13 hours). Labor requirements for supporting operations, which comprise a relatively small part of the total, are about the same for all three systems.

The unproductive labor inherent in performing dressing-line operations is 9.25 man-hours with the three-bed system, 4.87 man-hours with the gravity system, and 3.31 man-hours with the powered system. The overall efficiency of the rail systems permits work elements to be

divided more evenly among the workers so that job-regulated wait time is considerably smaller than in the three-bed system.

CATTLE KILLING-FLOOR LAYOUTS

The primary aim in designing cattle killing-floors is to provide the most efficient dressing-line and supporting operations. At least seven factors should be considered: (1) Proposed volume and weights of cattle to be slaughtered, (2) paths of flow for carcasses and byproducts, (3) equipment arrangement,

(4) space requirements, (5) inspection and sanitation requirements, (6) the location of the floor with respect to other components of the plant proper, and (7) future expansion.

The volume and the weight of animals to be slaughtered have a material effect on the size of floor and the kind and type of equipment needed for performing dressing-line and supporting operations efficiently. At the outset management must determine the anticipated hourly rate of kill and the weights of animals to be slaughtered, so that the equipment types and sizes and space requirements for the floor can be established.

Equipment and work stations for performing both cattle-dressing and supporting operations must be arranged so that paths of flow are short and direct to minimize transport distances for carcasses and byproducts and walking distances for workers and inspectors. Space for work areas is governed by the type and size of equipment, plus the working space required for each employee and for equipment cleaning.

Consideration should also be given to future expansion because a significant change in volume (weight of the animals, as well as the number processed) will affect the floor area needed for an efficient operation. Plans for expansion should provide for the removal of a minimum amount of the exterior walls.

Inspection and sanitation authorities have rigid requirements for killing floor design and construction. Plans for new killing floors or the expansion of existing ones should be submitted to the proper authorities for approval before construction begins.

Efficient layouts are presented for the three-bed system, the gravity system, and the powered system. The designs for all three layouts are based on slaughtering cattle weighing between 500 and 700 pounds (dressed weight) at the rate of 24 head per hour. Assuming an 8-hour day operation, and 260 operating days a year, the annual slaughtering volume for the floors would amount to about 50,000 cattle.

Layout for a Killing Floor Using the Three-Bed System

A suggested layout for a killing floor using the three-bed system for slaughtering operations is shown in figure 13. The floor is one large room about 72 feet long and $57\frac{1}{2}$ feet wide, or 4,140 square feet. The layout shows the arrangement of work areas and equipment for performing all killing-floor operations. The layout also shows suggested floor drains essential for maintaining cleanliness and floor drain slope lines. Lavatories are conveniently located for washing hands and tools. The layout is discussed on the basis of work areas for dressing-line operations and work areas for supporting operations.

Work Areas for Dressing-Line Operations

The work areas of the killing floor for performing dressing-line operations are designated by the numbers of the areas shown in figure 13.

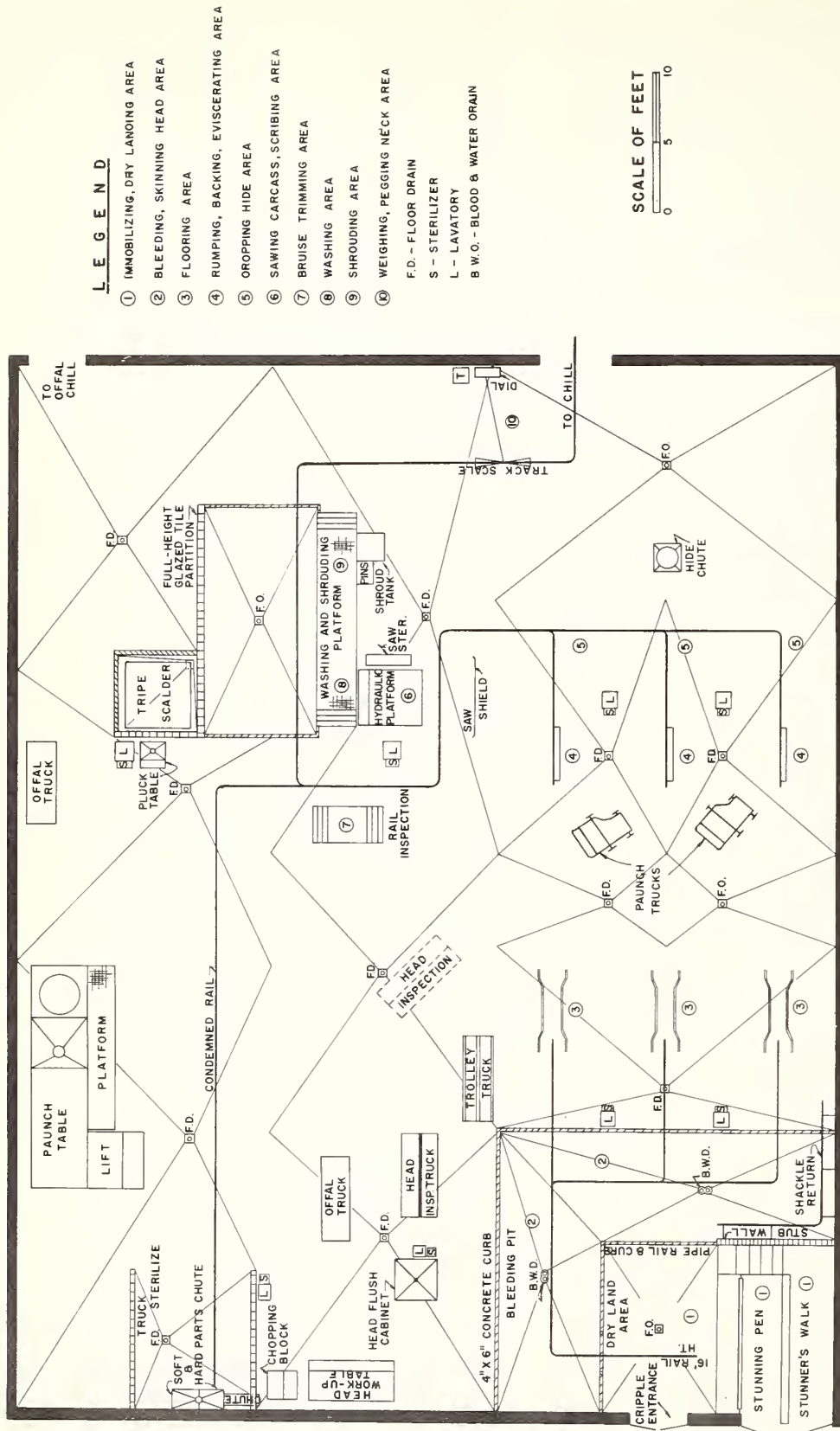
The approximate space required for performing dressing-line operations with the 3-bed system is 2,203 square feet, or about 53 percent of the total killing-floor area. This area is equipped with 69 feet of bleeding rail, which is installed 16 feet above the floor and 175 feet of dressing rail installed 11 feet above the floor. About 48 feet of the dressing rail is used as a rail for condemned carcasses.

The bleeding rail extends into the flooring area. In the bleeding pit area, the bleeding rail separates into three spur rails, 8 feet apart, each leading to a skinning cradle in the flooring area. Two rail switches are used at junction points of the spur rails to allow carcasses to be moved onto these rails. A short section of bleeding rail (about 18 feet) is used as a shackle-return rail and extends through the bleeding pit from the flooring area to the dry-landing area. It is about 4 feet high at the flooring area and declines to 3 feet at the dry-landing area to allow shackles to return to the dry-landing area by gravity flow.

Eighteen feet in a line from the flooring dropoff points of the bleeding rail spurs, three dressing-rail spurs are installed at the rumpling, backing, eviscerating area. These spurs extend into the dropping-hide area and converge into one rail by means of two dressing-rail switches. The dressing rail extends on through the remaining dressing areas on the killing floor and leads into a chill room. At the bruise-trimming area a dressing rail switch allows condemned carcasses to be moved onto a rail which leads to a point over the soft and hard parts chute.

Work area 1.--The stunner's walk is $2\frac{1}{2}$ feet wide by 12 feet long with steps at one end leading to the dry-landing area. The walk is 4 feet above the floor level of the adjacent stunning pen. The 10-foot long stunning pen is 3 feet wide at the top; the wall adjacent to the stunner's walk slopes so that the pen is 2 feet wide at the bottom. The floor of the pen is sloped slightly to keep the animal off balance and permit easier rollout onto the dry-landing area. A revolving pen door forms the opposite wall of the pen. Release of the latch of this pen door allows the immobilized animal to roll out onto the dry-landing area. The floor of the pen is about $1\frac{1}{2}$ feet above the dry-landing floor, thus eliminating any necessity of dragging animals from the pen. The walk and pen occupy about 100 square feet.

An 8- by 12-foot curbed and separately drained area comprises the dry-landing area. Two sides are enclosed by a 4-foot-high pipe rail to prevent any improperly stunned animals



LEGEND

- ① IMMOBILIZING, DRY LANDING AREA
 - ② BLEEDING, SKINNING HEAD AREA
 - ③ FLOORING AREA
 - ④ RUMPING, BACKING, Eviscerating AREA
 - ⑤ DROPPING HIDE AREA
 - ⑥ SAWING CARCASS, SCRIBING AREA
 - ⑦ BRUISE TRIMMING AREA
 - ⑧ WASHING AREA
 - ⑨ SHROUDING AREA
 - ⑩ WEIGHING, PEGGING NECK AREA
- F.D. - FLOOR DRAIN
 S - STERILIZER
 L - LAVATORY
 B.W.O. - BLOOD & WATER DRAIN

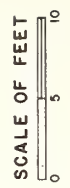


Figure 13.--A suggested layout for a three-bed killing floor system designed to slaughter 24 cattle per hour.

from escaping onto the rest of the killing floor. The rail has two 18-inch openings, one providing access to the bleeding pit for the worker and one allowing the carcass to move on the rail to the pit. Crippled animals may be unloaded directly onto the dry landing area through the cripple entrance. An automatic landing hoist is installed above the end of the bleeding rail for raising and transferring carcasses to this rail.

Work area 2.--The bleeding pit is L-shaped and includes an area of about 282 square feet. It is bordered by a raised concrete curb 4 inches wide and 6 inches high to permit separate drainage. Two 4-inch-diameter blood and water drains are provided for this area. About 28 feet of the bleeding rail is used for bleeding and head skinning. Approximately 15 large animals may be held on the rail.

Work area 3.--The area is 26 feet by 16 feet. Three separate beds are provided, each with a cattle-skinning cradle. The bleeding rails leading to the cradles have dropoff points 7 feet from the curb of the bleeding pit. A friction dropper is installed above the rail at each of the dropoff points for lowering the carcasses into the skinning cradles. Two sterilizing lavatories are conveniently located in the area for use by the workers in washing their hands and tools. A trolley truck is also located in the area as a storage for clean trolleys used in the flooring operation.

Work area 4.--A hoist with spreader attached is installed above the end of each dressing rail spur in this 16- by 24-foot area. A single rail landing device is also located on the end of each rail spur. The 18-foot distance between dropoff at flooring and landing at rumping, backing, eviscerating allows necessary aisle space for movement of paunch trucks and inspectors. Each dressing rail spur extends over 8 feet of the rumping, backing, eviscerating area. Two sterilizing lavatories are also located in the area.

Work area 5.--An area 12 by 24 feet is needed to provide working space and accommodate equipment for dropping hides. One central hide chute accommodates all hides dropped to the hide cellar. The sterilizing lavatories used by the rumpers are also used by the hide dropper.

Work area 6.--An area approximately 10 feet by 11 feet is needed for sawing carcasses. A metal saw shield is provided opposite the hydraulic platform to shield other areas from bone dust. The suggested hydraulic platform allows the worker to saw each carcass into sides without the tiring effort of bending; the platform descends as he performs his sawing work. The beef carcass saw is suspended from a support next to the rail. The saw is counter-balanced for easy handling and is sterilized after each sawing operation in a saw sterilizer next to the platform. A sterilizing lavatory is

located on the opposite side of the platform. A pneumatic spreader mounted on the dressing rail opposite the platform spreads the hind legs of the carcass in preparation for sawing.

Work area 7.--An area 6 by 14 feet provides working space for the employee and space for a 3- by 4- by 3-foot high stationary metal platform.

Work areas 8 and 9.--The washing and shrouding operations are performed from a stationary metal platform 3 by 20 by 4 feet high. A shroud container and shroud pin container are attached to the back of the platform. A total of 288 square feet is required to provide sufficient space for equipment and employees' working space. A separately curbed and drained area 8 feet by 16 feet is adjacent to the platform and a full-height glazed tile partition is located at the edge of the curbed area opposite the platform to prevent water from splashing to other work areas. The washer uses a hydraulic cattle wash unit to obtain high pressure sprays.

Work area 10.--An area 17 feet long by 9 feet wide is used. Carcasses can be backlogged on about 15 feet of rail before reaching the track scales which are installed as a portion of the dressing rail opposite the scale dial. Another 16 feet of rail leads past the track scales and to the chill cooler door. A metal table (2 by 2 feet) is provided next to the scale dial for recording work done by the weigher.

Work Areas for Supporting Operations

Space is suggested on the layout for the three-bed system for work areas in which to perform the following supporting work: (1) Head workup; (2) transporting viscera; (3) pluck and paunch workup; and (4) condemned products handling. The total portion of the killing floor suggested for supporting work comprises about 1,947 square feet.

Head workup.--An 18- by 20-foot area is suggested. Adequate space is provided for a 3- by 3-foot head flush cabinet, a chopping block, two sterilizing lavatories, two head-inspection trucks, an offal truck, and a 3- by 6-foot head workup table.

Transporting viscera.--About 710 square feet are allocated. Movements are described in table 11 of the appendix. All of the equipment used in this area is mobile and consists of two 225-pound-capacity tub trucks, a drum truck, and two paunch trucks. A separately partitioned (with partial walls) truck-sterilizing area (9 by 10 feet) is used for rinsing paunch trucks after each trip. The worker uses the sterilizing lavatory located next to the chopping block in the head workup area.

Pluck and paunch workup.--This work is not included as a part of this study; however, 877 square feet are provided on the layout. In addition to working space for employees, space is

provided for an 8- by 14-foot paunch table with lift and platform, a pluck table (2 by 2 feet), a tripe scalding (6 by 6 feet), an offal truck, and a sterilizing lavatory.

Condemned products handling.-- This work is not included as a part of this study, but the killing floor includes space for a soft and hard parts chute in the truck sterilizing area to dispose of condemned material and head bones.

Expansion of the Three-Bed System

To increase the rate of kill from 24 to 35 head per hour with the 3-bed system, it would be necessary to: (1) Increase the number of workers performing dressing-line and supporting operations; (2) reassign some of the elements of work performed on the dressing line to supporting operations; (3) substitute a two-level platform for the present one-level platform to allow both washing and shrouding operations to be done on two levels; and (4) redistribute the dressing-line work among the workers in the larger crew. No increase in floor area would be required. The pace-setting operation, when slaughtering at the rate of 35 head per hour should not exceed 2.86 man-hours per 100 cattle. The proposed expansion is based on observations of floors slaughtering at that rate. A time study would be needed to align all elements of work so that the operations could be performed with the highest degree of efficiency.

In general, one worker would be added to each of the following areas: (1) Driving, immobilizing, dry landing; (2) flooring; (3) rumping, backing, eviscerating; (4) dropping hide; (5) head workup; and (6) transporting viscera.

Major changes to the work arrangement for dressing-line operations with the larger crew would be: (1) Driving would be assigned to a pen man, leaving the other worker the jobs of immobilizing, dry landing; (2) flooring would be redistributed among six workers; (3) rumping would be performed by two workers, backing by one worker, and eviscerating by one worker. The eviscerator, under the expanded rate of kill, would not transport viscera; (4) dropping hides would be redistributed among two workers; (5) scribing would be transferred to bruise-trimming; (6) times required for washing and shrouding would be lowered with use of two-level platform; and (7) part of the low shrouding work would be shifted to the weighing, pegging-neck operation.

Major changes to the work arrangement for supporting operations with the larger crew would be: (1) Head workup would be redistributed among three workers, and (2) transporting viscera would be assigned to a full-time worker.

The expanded rate of kill would require 20 dressing-line workers and four supporting

workers. Other minor changes in the reallocation of work in dressing-line and supporting operations would be necessary. These minor changes are not discussed in this study.

Layout for a Killing Floor Using the Gravity On-the-Rail System

A suggested layout for a killing floor using the gravity on-the-rail system for performing slaughtering and dressing operations is shown in figure 14. The overall area of the floor is 2,650 square feet, housed in an L-shaped layout. Location of floor drains and floor drain slope lines are in the layout. All operations are performed within specific areas; the layout is discussed on the basis of work areas for dressing-line operations and for supporting operations.

Work Areas for Dressing-Line Operations

The work areas on the killing floor for performing dressing-line operations are designated by the numbers of the areas shown in figure 14.

The approximate space required for facilities, workers, and equipment in the dressing-line work areas with the gravity system is 1,455 square feet, or 55 percent of the total floor area. The room houses 79 feet of gravity-flow bleeding rail of which 27 feet are used as a shackle return rail. The bleeding rail begins at a 17-foot height in the dry landing area and extends through the bleeding pit, gradually declining to a 15-foot 8-inch height at the second-transfer, release-bung area. At this area, the rail becomes a gravity-flow shackle return rail and leads back to the dry landing area. The bleeding rail has six mechanical rail stops at 5-foot intervals alternating from cushion stop to work stop.

The gravity-flow dressing rail contains 160 feet of rail, of which 60 feet are used as a spreader return rail and 42 feet as the non-gravity-flow spur rail. The remaining 58-foot gravity-flow rail extends from the second-transfer, release-bung area through the sawing-carcass, scribing area; it is 16 feet 4 inches high at the second-transfer release-bung area and descends to a height of 11 feet 4 inches at the sawing-carcass, scribing area. The spreader return rail is an extension of the gravity-flow rail from the sawing-carcass, scribing area leading back to the second-transfer, release-bung area. The spur rail extends from the sawing-carcass, scribing area through the weighing, partial-shrouding area. A short section of rail extends off the spur rail at the rail inspection point and is used for holding condemned carcasses.

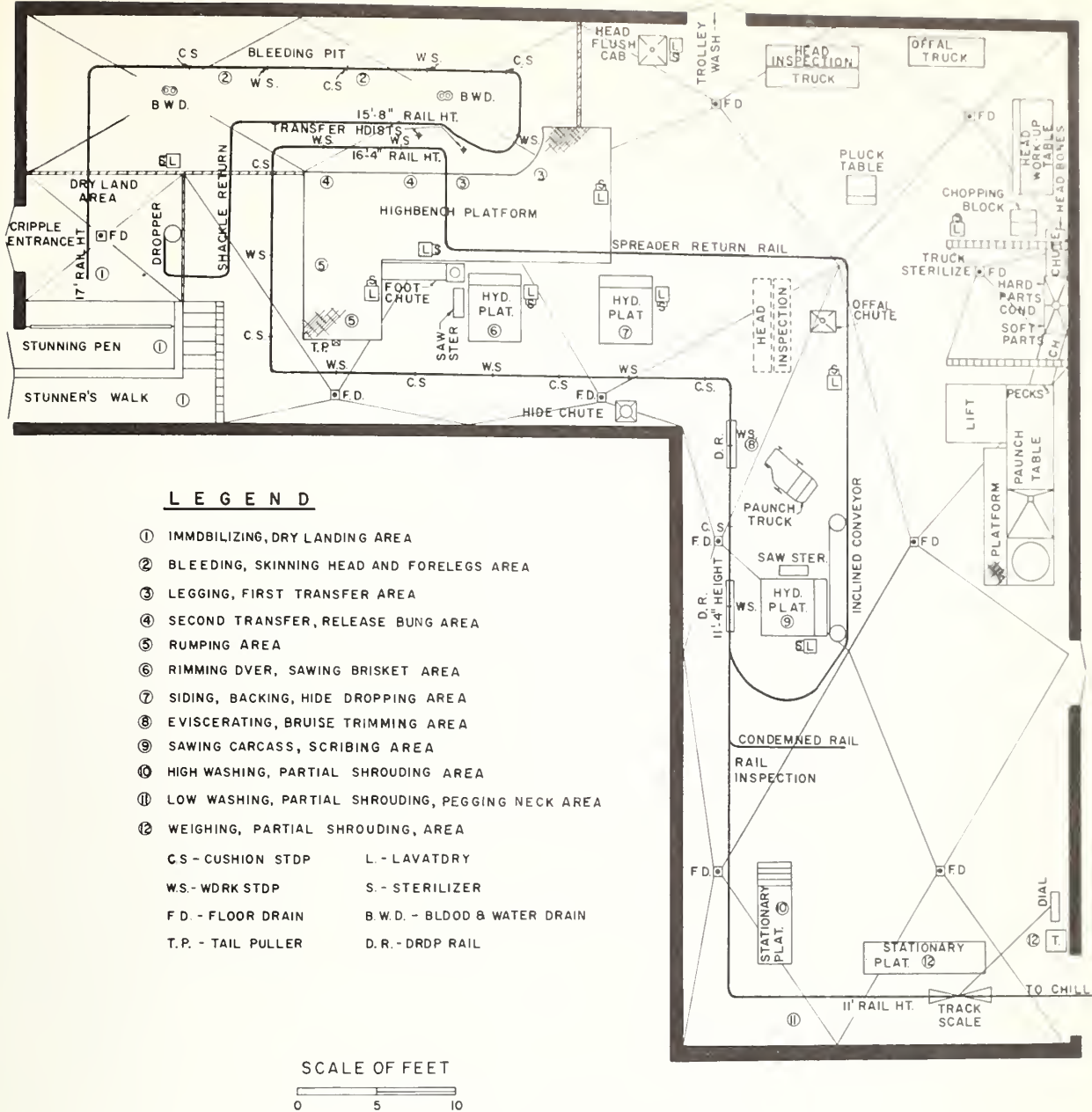


Figure 14.--A suggested layout for a gravity on-the-rail killing-floor system designed to slaughter 24 cattle per hour.

Mechanical rail stops are installed at 5-foot intervals from the second-transfer, release-bung area to the sawing-carcass, scribing area. The first two are work stops; the others alternate from cushion stop to work stop.

A powered incline conveyor, considered a part of the dressing-rail system, is installed in a portion of the spreader return rail directly behind the sawing-carcass, scribing area. Its function is to raise the spreaders to a height of about $17\frac{1}{2}$ feet in order that they may travel

by gravity flow back to the second-transfer, release-bung area.

Work area 1.--With the exception of size of the dry landing area and the use of a shackle return dropper, the immobilizing, dry landing area for the gravity system is similar to that for the 3-bed system. The dry landing area in this system is 8 by 10 feet. The shackle return rail is equipped with a dropper to lower shackles to working level. An entrance in this

area allows crippled animals to be loaded directly onto the dry landing area.

Work area 2.--A separately curbed and drained area measuring 35 by 9½ feet makes up the bleeding, skinning-head, forelegs area. Two 4-inch diameter blood and water drains and a sterilizing lavatory are located in the area. A portion of the gravity-flow dressing rail (about 12 feet), positioned for transferring carcasses from the bleeding rail, parallels the bleeding rail at a distance of 1½ feet. The foot chute used for work in this area is described in the paragraph on work area 3.

Work areas 3, 4, and 5.--A total of 281 square feet is required in the areas for legging, first-transfer; second-transfer, release-bung; and rumping. Space is provided for an irregularly shaped, metal highbench platform (7 feet 4 inches high and 160 square feet).

The legging, first-transfer area occupies about 53 square feet of the platform. Equipment consists of a transfer hoist, a sterilizing lavatory, and a foot chute, which is partly under the platform. The chute has two openings, one under the platform for use of the worker in the bleeding, skinning head, forelegs area, and the other outside the platform, for use of the worker in the legging, first-transfer area.

Forty-five square feet of the highbench platform are used for the second-transfer, release-bung operation. A transfer hoist and a sterilizing lavatory constitute the equipment.

The rumping area requires 25 square feet of the platform plus 110 square feet of floor area for carcass movement. A sterilizing lavatory and a hydraulic tail puller are located on the platform.

Work area 6.--Ninety square feet are required. A hydraulic platform, saw sterilizer, sterilizing lavatory, and a counterbalanced beef brisket saw are used in the area.

Work area 7.--This 90-square-foot area includes a hydraulic platform and a sterilizing lavatory. A hide chute is installed directly opposite the dressing rail and hydraulic platform.

Work area 8.--Approximately 100 square feet (an L-shaped area) are required. The dressing rail in the area is equipped with a drop-rail section which allows carcasses to be lowered a maximum of 3 feet from the dressing rail height. The section is 4 feet long. A sterilizing lavatory and a paunch truck are shown in the area.

Work area 9.--An area 10 by 10 feet is needed for working space and equipment: A hydraulic platform, saw sterilizer, sterilizing lavatory, and counterbalanced beef carcass saw. The dressing rail is equipped with a drop-rail section allowing carcasses to be lowered a maximum of 8 inches. It is 4 feet long.

Work areas 10 and 11.--The high washer performs his work while standing on a metal

stationary platform, 3 feet wide, 7 feet long, and 4 feet high. A hydraulic cattle wash unit is provided to supply water under pressure. A tank for holding a supply of shrouds is on the platform. The low washer stands on the floor at the end of the platform to perform his work. About 130 square feet are required for both work areas, the high wash area requiring about 80 square feet of the L-shaped area.

Work area 12.--The floor space allocated is about 10 by 15 feet. A stationary platform, 1 foot high by 2 feet wide by 8 feet long, is located here. A scale is installed on the dressing rail opposite the platform.

Work Areas for Supporting Operations

Adequate space is suggested on the killing floor with the gravity on-the-rail system for the following supporting work: (1) Head workup; (2) transporting viscera; (3) pluck and paunch workup; and (4) handling condemned products. The total area of the floor suggested for supporting work includes 1,195 square feet.

Head workup.--The equipment includes a 3- by 3-foot head flush cabinet, a 3- by 6-foot head workup table, two head-inspection trucks, a chopping block, an offal truck, two sterilizing lavatories, and a head bone chute. The total working and equipment space allocated is 386 square feet.

Transporting viscera.--A total of 236 square feet is required for transporting viscera in the gravity system. This area consists largely of passageways between work areas for transporting viscera and offal by tub truck, drum truck, and paunch truck. A sterilizing lavatory located in the head workup area is used by the transporter. The truck sterilizing area is 9 by 10 feet and is set off by partial-height walls.

Pluck and paunch workup.--As in the 3-bed system, pluck and paunch workup is not a part of this study; however, space is suggested and provided on the layout (figure 14) for this work. An area of 573 square feet is allocated. Space is provided for an 8- by 14-foot paunch table with platform and lift attached, a 2- by 2-foot pluck table, a peck (omasum) chute, and offal chute. The eviscerator's sterilizing lavatory is usually used by workers in this area.

Handling condemned products.--This work is not included as a part of the study, but space is provided for a soft and hard parts chute in the truck sterilizing area to accommodate condemned material.

Expansion of the Gravity On-the-Rail System

Increasing the rate of kill from 24 to 35 head of cattle per hour with the gravity on-the-rail system would require: (1) An increase in the

number of workers performing dressing-line and supporting operations; (2) redistribution of work among workers; (3) assignment of some dressing-line work to supporting operations; (4) establishment of new work areas; (5) addition and rearrangement of some equipment; and (6) minor facility changes.

No increase in total floor area would be necessary. Figure 15 shows the killing floor expanded to process 35 cattle per hour.

The expanded floor design is based on observations of gravity systems slaughtering at the rate of 35 head per hour. The elements performed in slaughtering at the 24-per-hour rate would have to be regrouped for the 35-per-hour rate. Some elements would be redistributed among more than one operation and increase the over-all time for the element. More study would be required to determine the proper combination of elements to form operations for

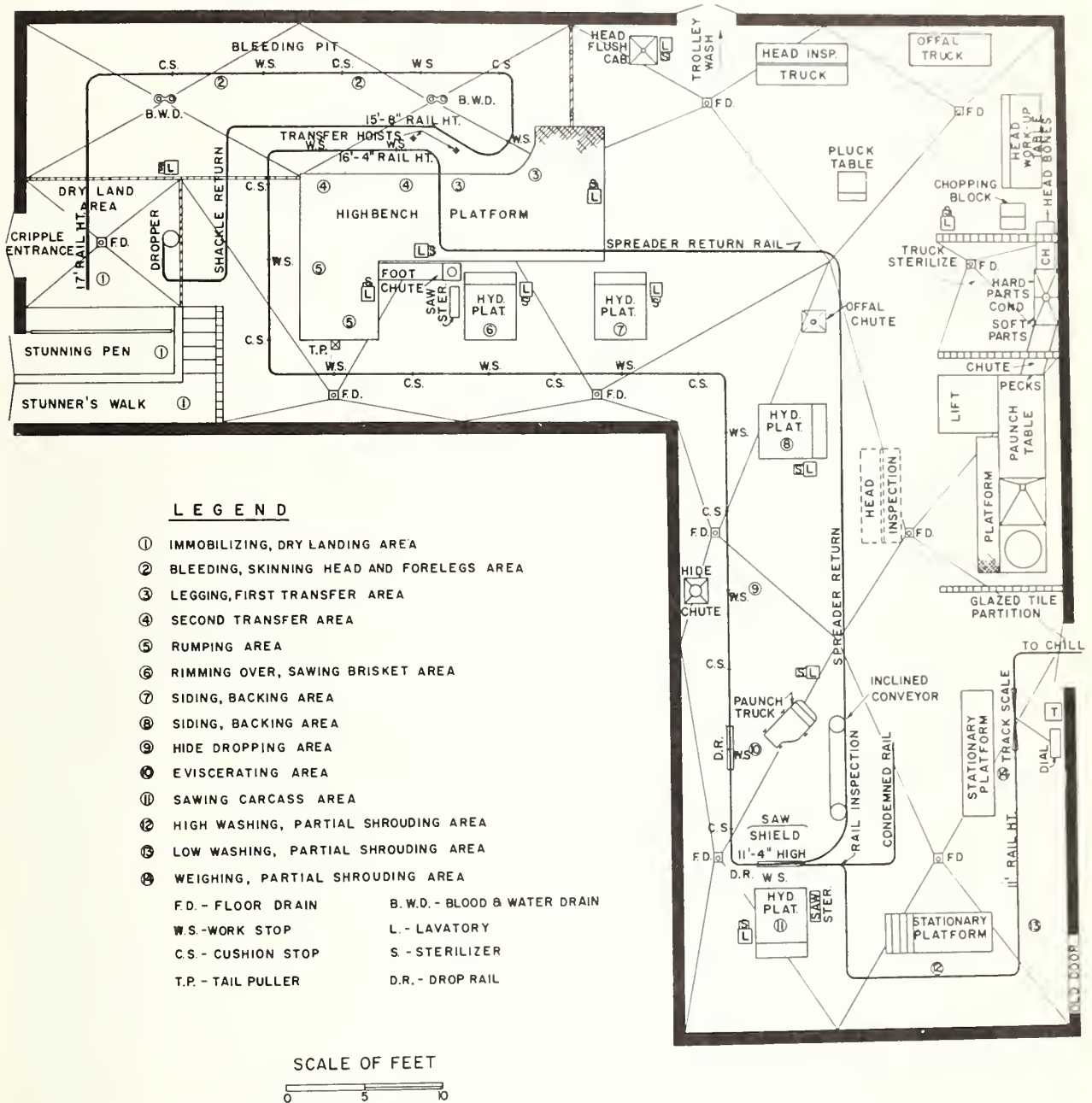


Figure 15.--Suggested layout of a gravity on-the-rail killing-floor system expanded to handle 35 carcasses per hour.

conducting the work efficiently in the expanded layout. The line operations would be performed in the 14 major work areas shown in the layout. The pace-setting operation, when slaughtering at the rate of 35 cattle per hour, should not exceed 2.86 man-hours per 100 cattle.

In work areas one through seven, no additional equipment would be needed to expand the rate of slaughter. In work area eight, a hydraulic platform would be added to the line to assist a worker in the siding, backing work. The present hide chute would be relocated as shown in figure 15. The drop-rail section used in area 10 would be relocated but no additional equipment would be required for work areas 9 and 10. The drop-rail section and hydraulic platform in area 11 would be relocated and a saw shield installed opposite the platform. Approximately 20 feet of dressing rail would be added to the expanded system to permit the increased rate of kill. The last three line-work areas would be relocated as shown in figure 15, but no additional equipment would be needed. In summary, the increased rate of slaughter would require an additional hydraulic platform and 20 more feet of dressing rail.

About 17 dressing-line workers and four supporting workers would be required.

The facility changes would be a relocation of the chill room entrance as shown in figure 15 and erection of a glazed tile partition next to the chill-room door.

Layout for a Killing Floor Using the Powered-On-the-Rail System

The layout shown in figure 16 suggests an arrangement of equipment and working space employing the powered on-the-rail system to dress 24 cattle per hour of the 500- to 700-pound dressed weight class. The killing floor is 63 feet long by 40 feet wide (2,520 square feet). Locations of equipment, facilities, and work areas are noted on the layout. Floor drains with slope lines are also shown in suggested locations on the layout.

The following sections describe the working areas of the dressing line and supporting operations.

Work Areas for Dressing-Line Operations

About 1,550 square feet, 62 percent of the total floor area, is required for dressing-line operations. Beginning in the dry landing area at a height of 17 feet 1 inch, 45 feet of gravity-flow bleeding rail extends through the bleeding pit and legging, first-transfer work area declining to a height of 16 feet 4½ inches at this point. Mechanical rail stops are located on the bleeding rail at 5-foot intervals. At the legging, first-transfer area, the bleeding rail bends and

extends back to a corner of the bleeding pit near the dry landing area. This section of the rail is 26 feet in length and is used as a shackle-return rail. At the end of the rail, in the bleeding pit, a shackle dropper is used to lower shackles to working level.

Separated from the bleeding rail by 2 feet and beginning at the second-transfer remove-udder area, 102 feet of chain-driven powered rail extends through the sawing-carcass, bruise-trimming area and back to the second-transfer, remove-udder area to form a complete rectangle. The bleeding rail and powered dressing rail are installed a distance of 4 feet from the wall opposite the highbench platform and hide-dropping area to allow adequate passageway between the wall and carcasses on the rails. About half of this powered section is used as a spreader return rail from the sawing-carcass, bruise-trimming area. Carcasses are spaced on 5-foot centers on the powered section of the rail except along each side of the viscera inspection table where they are spaced on 8-foot centers. Mechanical rail stops are not used in this system because the entire power-driven line moves at one time thereby moving each carcass to the next work station or backlog area. Work stops and cushion stops shown in figure 16 signify work areas and backlog areas. Another 100 feet of spur rail (non-powered) begins below the powered rail at the sawing-carcass, bruise-trimming area and extends through the remaining dressing line work areas to the chill coolers. It is 15 feet, 8 inches high at the sawing-carcass area. A decline conveyor located in this section of rail a few feet past the sawing-carcass area lowers carcasses to 11-foot 4-inch height. Manual movement of carcasses is required through the remaining work areas of weighing, washing, and shrouding, pegging neck.

The powered section of the dressing rail has a drop-rail section at the eviscerating, separating-paunch area which allows carcasses to be lowered a maximum of 3 feet. Another drop-rail section (maximum drop 8 inches) is installed at the sawing-carcass work area for transferring trolleys from spreaders to the nonpowered dressing rail.

About 40 feet of dressing rail are used for retaining carcasses and as a condemned-carcass rail, which leads to a point above the condemned hard-parts chute.

Work area 1.--A total floor area of 169 square feet is required. The dry landing portion of the area is 7 by 12 feet. At one end of the area, an entrance allows crippled animals to be unloaded directly onto the dry landing floor. The opposite end is bordered by a concrete curb and a 4-foot-high pipe railing. An 18-inch opening in the pipe railing allows passage of carcasses into the bleeding pit. The shackle dropper is located at the edge of the dry landing area in the bleeding pit. One side

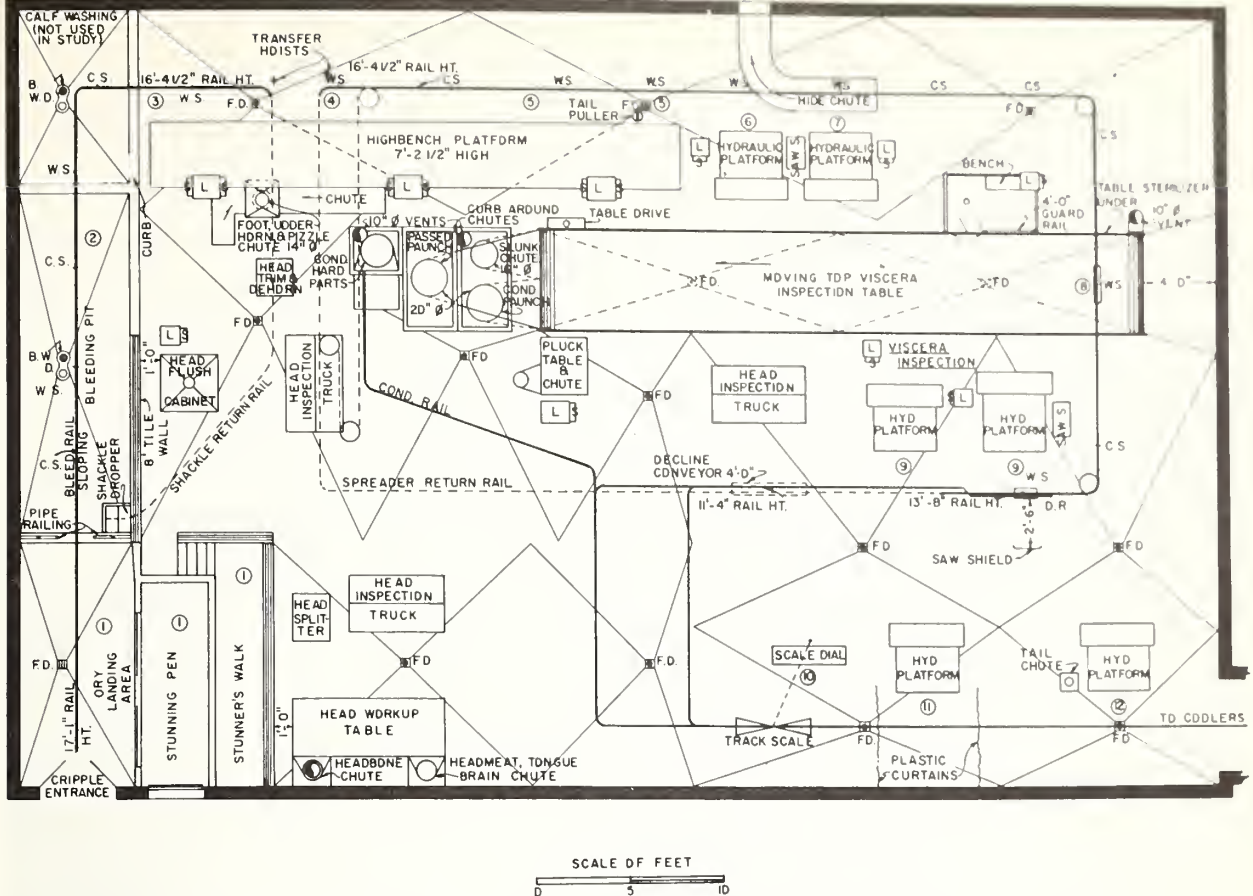


Figure 16.--Suggested layout of a powered on-the-rail killing-floor system designed to slaughter 24 cattle per hour.

LEGEND

- 1 Immobilizing, dry landing area
- 2 Bleeding, skinning head, forelegs area
- 3 Legging, first transfer area
- 4 Second transfer, remove udder area
- 5 Rumping, release bung area
- 6 Rimming over, sawing brisket area
- 7 Siding, backing, hide dropping area
- 8 Eviscerating, separating paunch area
- 9 Sawing carcass, bruise trimming area
- 10 Weighing area

- 11 Washing area
 - 12 Shrouding, pegging neck area
- C.S. - Cushion stop
W.S - Work stop
F.D - Floor drain
B,W.D. - Blood and water drain
L. - Lavatory
S. - Sterilizer
D.R. - Drop Rail

of the dry landing area is bordered by a wall and the opposite side by the stunning pen. The stunning pen and stunner's walk are similar to those described in the other two systems.

An automatic landing hoist is installed above the end of the bleeding rail in the dry landing area. A revolving door is used in the stunning pen.

Work area 2.--The bleeding pit is 6 feet wide and 27 feet long, and is separately curbed and

drained. This layout has a 6- by 10-foot separately curbed and drained area especially designed for calf washing. However, in slaughtering heavy cattle, the area is used as a portion of the bleeding pit. Two blood and water drains are located in the pit. An 8-foot tile wall, about 12 feet long, borders that portion of the bleeding pit from the dry landing area past the head flush cabinet.

Work area 3.--A stationary metal high-bench platform 3 by 28 by 7 feet 2½ inches high is used in the areas for legging, first-transfer; second-transfer, remove-udder; and rumping, release-bung. A total of 283 square feet is required for working space and equipment for these three work areas.

Eighty-three square feet are required for working space and equipment for the legging, first-transfer area. This includes space for 24 square feet of the highbench platform, a transfer hoist, bleeding rail, sterilizing lavatory and chute for feet, udders, and pizzles.

Work area 4.--A total of 100 square feet is required for working space and equipment. It includes 30 square feet of the highbench platform, a sterilizing lavatory, transfer hoist, and powered dressing rail. The foot, udder, and pizzle chute located in the adjacent legging, first-transfer area is used.

Work area 5.--A total of 100 square feet is needed for working space and equipment in this work area. The equipment includes 30 square feet of highbench platform, powered dressing rail, sterilizing lavatory, and a hydraulic tail puller.

Work area 6.--Sixty-three square feet comprise the equipment and working space. A hydraulic platform, powered dressing rail, sterilizing lavatory, counterbalanced brisket saw, and a saw sterilizer are located in the area. A portion of the hide chute extends into the area.

Work area 7.--This area is also 63 square feet. It contains the hide chute, a hydraulic platform, sterilizing lavatory, and dressing rail.

Work area 8.--Two hundred and eighty square feet are required. Equipment located in the area includes a portion of the viscera inspection table, bench area for boot and tool washing, sterilizing lavatory, drop-rail section for lowering carcasses a maximum of 3 feet, and rail space for lead-in to the work area. A 4-foot guard rail surrounds the boot and tool washing area.

Work area 9.--Two hydraulic platforms are utilized in the area, one for sawing carcasses and partial scribing and the other for bruise-trimming and rail inspection. A sterilizing lavatory is located between the two hydraulic platforms. A saw sterilizer, counterbalanced beef carcass saw, drop-rail section (8-inch maximum drop) and saw shield complete the equipment located in the area. A total of 160 square feet is allocated to the work area providing space for equipment, carcass and worker movement.

Work area 10.--Approximately 130 square feet are needed for weighing and partial scribing. A dial scale with printing device, and track scale located in the spur rail constitute the necessary equipment. About 12 feet of

dressing rail provides room for a backlog of carcass sides to be held for scribing.

Work area 11.--Equipment in this 96-square-foot area includes a hydraulic platform and spur rail. Plastic curtains are hung on two sides of the work area to prevent water splashing into other areas.

Work area 12.--Located in 144 square feet are a hydraulic platform, tail chute, and spur rail.

Work Areas for Supporting Operations

Specific work areas suggested for supporting work for the powered system are: (1) Head workup, (2) transporting viscera, (3) pluck separation, and (4) condemned products handling. A total of 970 square feet is required. Most of the pluck and paunch workup areas are located off the killing floor in other departments.

Head workup.--An irregularly shaped area comprising 584 square feet is needed to provide working space for the head washer and head trimmer and the equipment that is used in the area. A head flush cabinet, sterilizing lavatory, two head inspection trucks, head workup table with chutes for head bones, head meat, tongues and brains, head trim and dehorn table, and head splitter are equipment located in the area. The foot chute located in the legging, first-transfer area is also used for horns by workers in this area.

Transporting viscera.--A total of 351 square feet is provided for working space, space for a sterilizing lavatory, paunch chute, and a portion of the moving top viscera inspection table. The paunch chute is curved and vented.

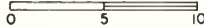
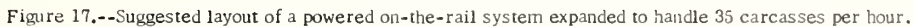
Pluck separation.--This area requires 10 square feet and includes a pluck table and chute and a sterilizing lavatory, plus working space for one employee. Work done in the area is not included as part of this study.

Condemned products handling.--This work is not included as a part of this study, but the required space is provided on the layout. Twenty-five square feet are needed for a condemned hard-parts chute and slunk (still-born calf) and condemned paunch chutes. These chutes are curved and vented.

Expansion of the Powered System

To increase the rate of slaughter from 24 to 35 head per hour on the suggested killing floor no increase in floor space would be required. The increased rate of slaughter could be obtained by rearranging major work areas, adding additional equipment, employing more workers, and redistributing the elements of work among the workers.

combination of elements to form operations and the redistribution of operations among workers for conducting work efficiently in the expanded system. The pace-setting operation when slaughtering at the rate of 35 cattle per hour should not exceed 2.86 hours per 100 cattle.



The increased rate of slaughter would require two additional hydraulic platforms and about 26 feet of dressing-line rail and rail for condemned products. One hydraulic platform would be added to the line in work area 8 to assist a worker in the siding, backing, and hide-dropping work. The present hide chute would be relocated as shown in figure 17. The second hydraulic platform would be added to the line in work area 12 to assist the inspector in inspecting cattle on the rail. The dressing rail and rail for condemned products would be extended between areas 12 and 13 to allow for the hydraulic platform added to area 12.

About 17 dressing-line workers and 4 supporting operation workers would be required to perform operations.

APPENDIX

Six tables have been developed as aids in comparing equipment costs and labor requirements. Tables 8, 9, and 10 show cost figures for each item of equipment used in each of the three cattle-dressing systems studied. Based on an annual volume of 50,000 cattle of 500 to 700 pounds dressed weight, costs per 100 cattle or carcasses were determined for each type of equipment. Tables 11, 12, and 13 include the base and productive times for each element of each operation in the three-bed, gravity on-the-rail, and powered on-the-rail systems. All times are based on 100 dressed beef carcasses weighing 500 to 700 pounds.

TABLE 8.--Three-bed cattle-killing floor system: Equipment ownership and operating costs for an annual volume of 50,000 head¹

Equipment	Amount of equip-ment	Size or capacity	Initial cost (f.o.b. factory)	Ex-pected life ² years	Ownership cost			Operating cost			Total annual cost	Cost per 100 cattle
					Deprecia-tion	Interest % of average invest-ment	Insurance and taxes (4% of initial investment)	Total	Water and electric-ity ³	Mainte-nance ⁴		
			Dollars	Years	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Revolving stunning-pen door...	1	---	613.00	12	51.08	18.39	24.32	93.99	---	24.00	117.99	0.2360
Captive-bolt stunner.....	2	cattle	265.00	10	26.50	7.95	10.60	45.05	---	1,764.00	1,809.05	3.6181
Automatic landing hoist.....	1	2,000 lb.	1,381.00	15	92.07	41.43	55.24	188.74	23.00	28.00	239.74	6.4795
Bleeding rail.....	100 ft.	---	482.50	20	24.13	14.48	19.30	57.91	---	5.00	62.91	1.2585
Beef shackles.....	20	53" long beef	510.00	10	51.00	15.30	20.40	86.70	---	5.00	91.70	7.1834
Blood and water drain.....	2	4" dia.	110.00	20	5.50	3.30	4.40	13.20	---	---	13.20	0.264
Sterilizing lavatory.....	1	---	130.00	20	6.50	3.90	5.20	15.60	2.00	1.00	18.60	0.372
Friction dropper.....	3	---	1,665.00	15	111.00	49.95	66.60	227.55	---	25.00	252.55	5.051
Cattle cradle.....	3	---	405.00	20	20.25	12.15	16.20	48.60	---	---	48.60	0.972
Sterilizing lavatory ⁵	2	2 knife boxes	284.00	20	14.20	8.52	11.36	34.08	13.00	3.00	50.08	1.002
Trolley storage rack.....	1	6' x 3"	230.00	15	15.33	6.90	9.20	31.43	---	2.00	33.43	0.669
Hoist with spreader, lander ⁶	3	200-lb., 5-hp.	3,780.00	15	252.00	113.40	151.20	516.60	30.00	38.00	684.60	13.692
Punch truck.....	3	---	690.00	15	46.00	20.70	27.60	94.30	---	6.00	100.30	2.006
Sterilizing lavatory.....	2	2 knife boxes	284.00	20	14.20	8.52	11.36	34.08	5.00	3.00	42.08	0.841
Hydraulic platform ⁷	1	1.5 hp.	1,217.00	15	81.13	36.51	48.68	166.32	5.00	24.00	195.32	3.904
Beef carcass saw.....	1	2 hp.	925.00	10	92.50	27.75	37.00	157.25	24.00	580.00	761.25	15.225
Pneumatic spreader.....	1	---	375.00	10	37.50	11.25	15.00	63.75	2.00	1.00	66.75	1.335
Sterilizing lavatory ⁸	1	1 knife box	130.00	20	6.50	3.90	5.20	15.60	---	---	15.60	0.312
Work platform ⁹	1	3' x 3'	175.00	20	8.75	5.25	7.00	21.00	---	---	21.00	0.42
Hydraulic cattle wash unit.....	1	3' x 20 ft.	780.00	20	39.00	23.40	31.20	93.60	---	---	93.60	1.872
Dial scales.....	1	20 G.F.M. 5-hp.	500.00	15	33.33	15.00	20.00	68.33	645.70	98.00	813.03	16.261
Dressing rail (including bolts, switches).....	140 ft.	1,600 lbs.	932.00	15	62.13	30.76	37.28	130.17	---	45.00	175.17	3.503
Standard beef trolleys.....	400	3/8" x 2 1/2"	319.00	20	15.95	9.57	12.76	38.28	---	3.00	41.28	0.826
Head flush cabinet.....	1	---	1,200.00	10	120.00	36.00	48.00	204.00	---	12.00	216.00	4.32
Head inspection truck.....	2	36" x 36" x 63"	219.00	20	10.95	6.57	8.76	26.28	4.00	2.00	32.28	0.646
Sterilizing lavatory.....	2	12 head	444.00	20	22.20	13.32	17.76	53.28	---	2.00	55.28	1.106
Head workup table.....	1	1 knife box	260.00	20	13.00	7.80	10.40	31.20	4.00	2.00	37.20	0.744
Offal truck.....	2	3 1/2 x 8 ft.	358.00	20	17.90	10.74	14.32	42.96	30.00	---	72.96	1.459
Tub truck.....	2	103 hooks	420.00	15	28.00	12.60	16.80	57.40	---	5.00	62.40	1.248
Drum truck.....	1	225 lb.	226.00	15	15.07	6.78	9.04	30.89	---	2.26	33.15	0.663
			82.00	15	5.47	2.46	3.28	11.21	---	0.82	12.03	0.241

¹ Based on dressed beef carcasses weighing 500 to 700 pounds.² Basis for number of years' depreciation: U.S. Internal Revenue Department's Bulletin F.³ Based on 2 cents per kw.-hr. for electricity and 0.03 cent per gallon for water.⁴ Based on average costs in the industry.⁵ Cost of shells for power is included in maintenance cost.⁶ Cost allocation by operation: Driving, immobilizing, dry larding \$0.0395; skinning head \$0.0601; flooring \$0.0262.⁷ Cost allocation by operation: Driving, immobilizing, dry larding \$0.0721; bleeding, skinning head \$0.0776; flooring \$0.037.⁸ For bleeding, head skinning operation.⁹ For flooring operation.¹⁰ For rumpling, backing, eviscerating operation.¹¹ Cost allocation by operation: Rumpling, backing, and eviscerating \$0.1003; transporting viscera \$0.1000.¹² Cost allocation by operation: Rumpling, backing, eviscerating \$0.0561; dropping hide \$0.0280.¹³ For sawing carcasses, scalding operation.¹⁴ For brine trimming operation.¹⁵ Cost allocation by operation: Washing \$0.0912; shrouding \$0.0960.¹⁶ Cost allocation by operation: Rumpling, backing, eviscerating \$0.0028; dropping hide \$0.0104; sawing carcasses, scalding \$0.0004; washing \$0.0004.¹⁷ Cost allocation by operation: Rumpling, backing, eviscerating \$0.0114; rumpling, backing, eviscerating \$0.0114; dropping hide \$0.0114; shrouding \$0.0114; weighing, pepping neck \$0.0070.¹⁸ Cost allocation by operation: Flooring \$0.0114; weighing, pepping neck \$0.0114; washing \$0.0114; shrouding \$0.0114; weighing, pepping neck \$0.0114.¹⁹ Cost allocation by operation: Head workup \$0.0372; transporting viscera \$0.0372.

TABLE 9.--Gravity-on-the-rail cattle-killing floor system: Equipment ownership and operating costs for an annual volume of 50,000 head

Equipment	Amount of equip-ment	Size or capacity	Initial cost (f.o.b. factory)	Ex-pected life ² Years	Ownership cost			Operating cost			Total annual cost	Cost per 100 cattle
					Deprecia-tion	Interest 6% of average invest-ment	Insurance and taxes (4% of initial investment)	Total	Water and electric-ity ³	Main-tenance ⁴	Total	
			Dollars	Years	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Revolving stunning pen door...	1	---	613.00	12	51.08	18.39	24.52	93.99	---	24.00	24.00	117.99
Captive-bolt stunner.....	2	cattle	265.00	10	26.50	7.95	10.60	45.05	---	51,764.00	1,764.00	1,809.05
Automatic landing hoist.....	1	2,000 lb.	1,381.00	15	92.07	41.43	55.24	183.74	23.00	28.00	51.00	3,618.1
Bleeding rail.....	80 ft.	1/2" x 3"	1,386.00	20	19.30	11.58	15.44	46.32	---	4.00	4.00	4,795
Snackie return dropper.....	1	---	1,062.00	20	53.10	31.86	42.48	146.32	---	52.00	52.00	6,106.6
Beef shackles.....	20	---	510.00	10	51.00	15.30	20.40	86.70	---	5.00	5.00	7,598.9
Blood and water drain.....	2	4 in. dia.	110.00	20	5.50	3.30	4.40	13.20	---	---	---	8,183.4
Sterilizing lavatory.....	1	1 knife box.	130.00	20	6.50	3.90	5.20	15.60	2.00	1.00	3.00	7,026.4
Transfer hoist ¹	1	2,000 lb.	1,018.00	15	67.87	30.54	40.72	139.13	21.00	10.00	31.00	8,372.2
Transfer hoist ¹	1	2,000 lb.	1,018.00	15	67.87	30.54	40.72	139.13	23.00	10.00	33.00	8,372.2
Highbench platform.....	1	160 sq. ft.	1,189.00	20	59.45	35.67	47.56	142.68	---	---	---	12,283.3
Sterilizing lavatory.....	3	2 knife boxes	426.00	20	21.30	12.78	17.04	51.12	6.00	3.00	9.00	13,120.3
Portable air saw.....	1	---	170.00	10	17.00	5.10	6.80	28.90	---	78.00	78.00	1,061.2
Mechanical knife.....	4	---	1,328.00	10	132.80	39.84	53.12	225.76	---	880.00	880.00	1,105.76
Beef spreaders.....	20	---	1,434.00	20	71.70	43.02	57.36	172.08	---	14.00	14.00	186.08
Spreaders.....	20	4-wheel	1,381.00	10	138.10	41.43	55.24	234.77	---	14.00	14.00	248.77
Standard beef trolleys.....	400	---	1,200.00	10	120.00	36.00	48.00	204.00	---	12.00	12.00	216.00
Gravity cattle rail system (conveyor with limit switch for returning 2-wheel trolley and spreader to point where carcass is transferred to spreader; approximately 160 ft. dressing rail).....	1	---	4,400.00	20	220.00	132.00	176.00	528.00	---	44.00	44.00	572.00
Tail clamp and hydraulic tail puller.....	1	---	400.00	15	26.67	12.00	16.00	54.67	---	8.00	8.00	62.67
Hydraulic platform, saw brackets, sterilizer ¹⁹	1	1.5 hp.	1,217.00	15	81.13	36.51	48.68	166.32	5.00	24.00	29.00	195.32
Bricket saw.....	1	1 hp.	865.00	10	86.50	25.95	34.60	147.05	5.00	500.00	505.00	652.05
Sterilizing lavatory.....	2	1 knife box	260.00	20	13.00	7.80	10.40	31.20	2.00	2.00	4.00	35.20
Hydraulic platform ²	1	1 hp.	925.00	15	61.67	27.75	37.00	126.42	3.00	19.00	22.00	148.42
Pneumatic drop rail section ²¹	1	3-ft. drop	880.00	20	44.00	26.40	35.20	105.60	---	10.00	10.00	115.60
Sterilizing lavatory ²²	1	2 knife boxes	142.00	20	7.10	4.26	5.68	17.04	3.00	1.00	4.00	21.04
Punch truck.....	1	---	230.00	15	15.33	6.90	9.20	30.43	---	2.00	2.00	32.43
Hydraulic platform with bracket and saw sterilizer ²⁴	1	1.5 hp.	1,217.00	15	81.13	36.51	48.68	166.32	5.00	24.00	29.00	195.32
Beef carcass saw.....	1	2 hp.	925.00	10	92.50	27.75	37.00	157.25	24.00	580.00	604.00	761.25
Pneumatic drop-rail section ²⁴	1	8-in. drop	808.00	20	40.40	24.24	32.32	96.96	---	10.00	10.00	106.96
Sterilizing lavatory ²⁴	1	1 knife box	130.00	20	6.50	3.90	5.20	15.60	2.00	1.00	3.00	18.60
Work platform, shroud container ²⁵	1	3 x 7 feet	525.00	20	26.25	15.75	21.00	63.00	---	---	---	63.00
Hydraulic cattle wash unit.....	1	20 G.P.M. 5 hp.	400.00	15	33.33	15.00	20.00	68.33	645.70	98.00	743.70	812.03
Work platform ²⁷	1	2 x 8 feet	500.00	20	20.00	12.00	16.00	48.00	---	---	---	48.00
Dial scales.....	1	1,600 lb.	932.00	15	62.13	30.76	37.28	130.17	---	45.00	45.00	175.17
Head flush cabinet.....	1	36" x 36" x 63"	219.00	20	10.95	6.57	8.76	26.28	4.00	2.00	6.00	32.28
Head inspection truck.....	2	12 head	444.00	20	22.20	13.32	17.76	53.28	---	2.00	2.00	55.28
Sterilizing lavatory.....	2	1 knife box	260.00	20	13.00	7.80	10.40	31.20	4.00	2.00	6.00	37.20
Head workup table.....	2	3 1/2 x 8 ft.	358.00	20	17.90	10.74	14.32	42.96	---	---	---	72.96
Offal truck.....	2	103 hooks	428.00	15	28.53	12.60	16.80	57.40	---	5.00	5.00	62.40
Tub truck.....	2	225 lb.	226.00	15	15.07	6.78	9.04	30.89	---	2.26	2.26	33.15
Drum truck.....	1	---	82.00	15	5.47	2.46	3.28	11.21	---	.82	.82	12.03

- 1 Based on dressed beef carcasses weighing 500 to 700 pounds.
- 2 Basis for number of years' depreciation: U. S. Internal Revenue Department's Bulletin F.
- 3 Based on 2 cents per kw-hr. for electricity and 0.03 cent per gallon of water.
- 4 Based on average costs in the industry.
- 5 Cost of shells for power included in maintenance cost.
- 6 Cost allocation by operation: Driving, immobilizing, dry landing \$0.0201; bleeding, skinning head, forelegs \$0.0507; legging, first transfer \$0.0293.
- 7 Cost allocation by operation: Driving, immobilizing, dry landing \$0.0477; bleeding, skinning head, forelegs \$0.0854; legging, first transfer \$0.0503.
- 8 Cost allocation by operation: Bleeding, skinning head, forelegs \$0.0132; legging, first transfer \$0.0132.
- 9 For bleeding, skinning head, forelegs operation.
- 10 For legging, first transfer operation.
- 11 For second transfer, release bung operation.
- 12 Cost allocation by operation: Legging, first transfer \$0.0951; second transfer, release bung \$0.0951; rumpung \$0.0951.
- 13 Cost allocation by operation: Legging, first transfer \$0.0401; second transfer, release bung \$0.0401; rumpung \$0.0401.
- 14 Cost allocation by operation: Second transfer, release bung \$0.3972; rumpung \$0.6950; rimming over, sawing brisket \$0.4744; siding, backing, hide dropping \$0.6849.
- 15 Cost allocation by operation: Second transfer, release bung \$0.0616; rumpung \$0.0567; rimming over, sawing brisket \$0.0692; siding, backing, hide dropping \$0.0994; eviscerating \$0.0697; sawing carcass \$0.0456.
- 16 Cost allocation by operation: Second transfer \$0.0823; rumpung \$0.0758; rimming over, sawing brisket \$0.0925; siding, backing, hide dropping \$0.0228; eviscerating, bruise trimming \$0.0932; sawing carcass, scribing \$0.0609.
- 17 Cost allocation by operation: Second transfer, release bung \$0.0518; rumpung \$0.0480; rimming over, sawing brisket \$0.0583; siding, backing, hide dropping \$0.0583; eviscerating, bruise trimming \$0.0588; sawing carcass, scribing \$0.0423; high washing, partial shrouding \$0.0389, low washing, partial shrouding \$0.0419; weighing, partial shrouding \$0.037.
- 18 Cost allocation by operation: Second transfer, release bung \$0.1374; rumpung \$0.1264; rimming over, sawing brisket \$0.1543; siding, backing, hide dropping \$0.147; eviscerating, bruise trimming \$0.1555; sawing carcass, scribing \$0.1121; high washing, partial shrouding \$0.1039; low washing, partial shrouding \$0.1110; weighing, partial shrouding \$0.0994; eviscerating, bruise trimming \$0.1032; sawing carcass, scribing \$0.0932; rimming over, sawing brisket \$0.0352; siding, backing, hide dropping \$0.0352.
- 19 For rimming over, sawing brisket operation.
- 20 Cost allocation by operation: Rimming over, sawing brisket \$0.0352; siding, backing, hide dropping \$0.0352.
- 21 For siding, backing, hide dropping operation.
- 22 For eviscerating, bruise trimming operation.
- 23 Cost allocation by operation: Eviscerating, bruise trimming \$0.0324; transporting viscera \$0.0324.
- 24 For sawing carcass, scribing operation.
- 25 For high washing, partial shrouding operation.
- 26 Cost allocation by operation: High washing \$0.8900; low washing partial shrouding \$0.734.
- 27 For weighing, partial shrouding operation.
- 28 Cost allocation by operation: Head pickup \$0.1372; transporting viscera \$0.0372.

TABLE 10.--Powered-on-the-rail cattle-killing floor system: Equipment ownership and operating costs for an annual volume of 50,000 head¹

Equipment	Amount of equipment	Size or capacity	Initial cost (f.o.b. factory)	Ex-pected life ² (years)	Ownership cost				Operating cost				Total annual cost	Cost per 100 cattle
					Deprecia-tion	Interest 6% of average invest-ment	Insurance and taxes (¼ of initial investment)	Total	Water and electric-ity ³	Mainte-nance ⁴	Total	Dollars		
			Dollars	Years	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars		
Revolving stunning pen door...	1	---	63.00	12	51.08	18.39	24.52	93.99	---	24.00	24.00	117.99	0.2360	
Captive-bolt stunner.....	2	cattle	265.00	10	26.50	7.95	10.60	45.05	---	1,764.00	5 1,764.00	1,809.05	3.6181	
Automatic landing hoist.....	1	2,000 lb.	1,381.00	15	92.07	41.43	55.24	188.74	23.00	28.00	51.00	239.74	4.7795	
Bleeding rail.....	80 ft.	1/2" x 3"	386.00	20	19.30	11.58	15.44	46.32	---	4.00	4.00	50.32	6.1006	
Shackle return dropper.....	1	---	1,062.00	20	53.10	31.86	42.48	127.44	---	52.00	52.00	179.44	7.3589	
Beef shackles.....	20	---	110.00	20	51.00	15.30	20.40	86.70	---	5.00	5.00	91.70	7.1834	
Blood and water drain.....	2	4-inch dia.	510.00	20	5.50	3.30	4.40	13.20	---	---	---	13.20	8.0264	
Sterilizing lavatory.....	1	1 knife box	130.00	20	6.50	3.90	5.20	15.60	2.00	1.00	3.00	18.60	0.372	
Transfer hoist ¹⁰	1	2,000 lb.	1,018.00	15	67.87	30.54	40.72	139.13	21.00	10.00	31.00	170.13	3.443	
Transfer hoist ¹¹	1	2,000 lb.	1,018.00	15	67.87	30.54	40.72	139.13	23.00	10.00	33.00	172.13	3.443	
Highbench platform.....	1	3 x 28 ft.	1,189.00	20	59.45	35.67	47.56	142.68	---	---	---	142.68	12.2853	
Sterilizing lavatory.....	3	2 knife boxes	426.00	20	21.30	12.78	17.04	51.12	6.00	3.00	9.00	60.12	13.1203	
Portable air-driven saw.....	1	---	170.00	10	17.00	5.10	6.80	28.90	---	78.00	78.00	106.90	2.138	
Mechanical knife.....	4	---	1,328.00	10	132.80	39.84	53.12	225.76	---	880.00	880.00	1,105.76	14.2215	
Beef spreaders.....	20	---	71.70	20	14.34.00	43.02	57.36	172.08	---	14.00	14.00	186.08	15.3722	
Spreader trolley.....	20	4-wheel	1,434.00	20	143.40	43.02	57.36	243.36	---	14.00	14.00	257.78	16.5156	
Standard beef trolleys.....	400	---	1,200.00	10	120.00	36.00	48.00	204.00	---	12.00	12.00	216.00	17.4320	
Powered cattle rail system (hydraulic drive); 4-8 tooth idlers; 2-6 tooth idlers; 1 take-up 6-tooth; drop finger conveyor-fingers on 5-foot centers; 102 ft. work chain; 23 ft. idle chain.....	1	10 hp.	9,792.00	15	652.80	293.76	391.68	1,338.24	20.00	147.00	167.00	1,505.24	18.30104	
Tail clamp and hydraulic tail puller.....	1	---	400.00	15	26.67	12.00	16.00	54.67	---	8.00	8.00	62.67	1.253	
Hydraulic platform with saw brackets and sterilizer ⁹ ...	1	1.5 hp.	1,217.00	15	81.13	36.51	48.68	166.32	5.00	24.00	29.00	195.32	3.906	
Briset saw.....	1	1 hp.	865.00	10	86.50	25.95	34.60	147.05	5.00	500.00	505.00	652.05	1.3041	
Sterilizing lavatory.....	2	1 knife box	260.00	20	13.00	7.80	10.40	31.20	2.00	2.00	4.00	35.20	2.0704	
Hydraulic platform ¹¹	1	1 hp.	925.00	15	61.67	27.75	37.00	126.42	3.00	19.00	22.00	148.42	2.2968	
Moving top viscera inspection table.....	1	3 hp., 5 x 33 ft.	9,254.00	20	462.70	277.62	370.16	1,110.48	9.00	45.00	54.00	1,164.48	22.3289	
Equipment wash platform.....	1	2 1/2 x 7 ft.	248.00	20	12.40	7.44	9.92	29.76	---	---	---	29.76	0.595	
Sterilizing lavatory ¹²	1	1 knife box	130.00	20	6.50	3.90	5.20	15.60	---	1.00	1.00	19.76	0.392	
Pneumatic drop-rail section ¹³	1	3 ft. dr.	880.00	20	44.00	26.40	35.20	105.60	---	10.00	10.00	115.60	2.312	
Hydraulic platform, saw brackets and sterilizer ²⁴ ...	1	1.5 hp.	1,217.00	15	81.13	36.51	48.68	166.32	5.00	24.00	29.00	195.32	3.906	
Beef carcass saw.....	1	2 hp.	925.00	10	92.50	37.00	50.00	157.25	24.00	580.00	604.00	761.25	1.5225	
Pneumatic drop-rail section ²⁴	1	8 inch dr.	808.00	20	40.40	24.24	32.32	96.96	---	10.00	10.00	106.96	2.139	
Mechanical scribe saw.....	1	---	340.00	15	22.67	10.20	13.60	46.47	---	125.00	125.00	171.47	3.429	
Sterilizing lavatory ²⁴	1	2 knife boxes	142.00	20	7.10	4.26	5.68	17.04	2.00	1.00	3.00	20.04	0.401	
Hydraulic platform ²⁴	1	1.5 hp.	925.00	15	61.67	27.75	37.00	126.42	5.00	19.00	24.00	150.42	3.008	
Dressing rail, bolts.....	115 ft.	1/2 x 2 1/2"	188.00	20	9.40	5.64	7.52	22.56	---	2.00	2.00	24.56	25.0491	
Dial scales with printing device.....	1	2,150 lb.	2,058.00	15	137.20	61.74	82.32	281.26	---	64.50	64.50	345.76	6.915	
Hydraulic platform ²⁶	1	1 hp.	925.00	15	61.67	27.75	37.00	126.42	3.00	19.00	22.00	148.42	2.2968	
Hydraulic cattle wash unit.....	1	20 G.P.M. 5-hp.	500.00	15	33.33	15.00	20.00	68.33	64.50	98.00	743.70	812.03	1.6241	
Hydraulic platform ²⁷	1	1.5 hp.	925.00	15	61.67	27.75	37.00	126.42	5.00	24.00	29.00	155.42	3.108	
Head flush cabinet.....	1	36" x 36" x 63"	219.00	20	10.95	26.57	8.76	26.28	4.00	2.00	6.00	32.28	0.646	
Head inspection truck.....	2	12 head	444.00	20	22.20	13.52	17.76	53.28	---	2.00	2.00	55.28	1.106	
Portable air-driven saw.....	1	1 knife box	170.00	10	17.00	5.10	6.80	28.90	---	78.00	78.00	106.90	2.138	
Sterilizing lavatory.....	2	2 x 2 feet	260.00	20	13.00	7.80	10.40	31.20	4.00	2.00	6.00	37.20	28.0744	
Dehorn table.....	1	---	100.00	20	5.00	3.00	4.00	12.00	---	---	---	12.00	0.240	
Head workup table.....	1	3 1/2 x 8 ft.	398.00	20	17.90	10.74	14.32	42.96	30.00	---	30.00	72.96	1.459	

- 1 Based on dressed beef carcasses weighing 500 to 700 pounds.
- 2 Basis for number of years' depreciation. U.S. Internal Revenue Department's Bulletin F.
- 3 Based on 2 cents per kw.-hr. for electricity and 0.03 cent per gallon of water.
- 4 Based on average costs in the industry.
- 5 Cost of shells for power stunner is included as maintenance cost.
- 6 Cost allocation by operation: Driving, immobilizing, dry landing \$0.0195; bleeding, skinning head, forelegs \$0.0491; legging, first transfer \$0.0320.
- 7 Cost allocation by operation: Driving, immobilizing, dry landing \$0.0464; bleeding, skinning head, forelegs \$0.0830; legging, first transfer \$0.0540.
- 8 Cost allocation by operation: Bleeding, skinning head, forelegs \$0.0132; legging, first transfer \$0.0132.
- 9 For bleeding, skinning head, forelegs operation.
- 10 For legging, first transfer operation.
- 11 For second transfer, remove under operation.
- 12 Cost allocation by operation: Legging, first transfer \$0.0951; second transfer, remove under \$0.0951; rumping, release bung \$0.0951.
- 13 Cost allocation by operation: Legging, first transfer \$0.0401; second transfer, remove under \$0.0401; rumping, release bung \$0.0401.
- 14 Cost allocation by operation: Second transfer, remove under \$0.5528; rumping, release bung \$0.5529; rimming over, sawing brisket \$0.5529; siding, backing, hide dropping \$0.5529.
- 15 Cost allocation by operation: Second transfer, remove under \$0.0663; rumping, release bung \$0.0640; rimming over, sawing brisket \$0.0680; siding, backing, hide dropping \$0.0681; eviscerating, separating paunch \$0.0714; sawing carcass, bruise trimming \$0.0344.
- 16 Cost allocation by operation: Second transfer, remove under \$0.0918; rumping, release bung \$0.0886; rimming over, sawing brisket \$0.0942; siding, backing, hide dropping \$0.0944; eviscerating, separating paunch \$0.0989; sawing carcass, bruise trimming \$0.0477.
- 17 Cost allocation by operation: Second transfer, remove under \$0.0452; rumping, release bung \$0.0477; rimming over, sawing brisket \$0.0507; siding, backing, hide dropping \$0.0509; eviscerating, separating paunch \$0.0533; sawing carcass, bruise trimming \$0.0473; weighing, partial scribbling \$0.0422; washing \$0.0424; shrouding, pegging neck \$0.0424.
- 18 Cost allocation by operation: Second transfer, remove under \$0.5358; rumping, release bung \$0.5175; rimming over, sawing brisket \$0.5497; siding, backing, hide dropping \$0.5512; eviscerating, separating paunch \$0.5777; sawing carcass, bruise trimming \$0.2765.
- 19 For rimming over, sawing brisket operation.
- 20 Cost allocation by operation: Rimming over, sawing brisket \$0.0352; siding, backing, hide dropping \$0.0352.
- 21 For siding, backing, hide dropping operation.
- 22 Cost allocation by operation: Eviscerating \$1.1208; separating paunch \$0.6731; transporting viscera \$0.5190.
- 23 For eviscerating, separating paunch operation.
- 24 For sawing carcass, bruise trimming operation.
- 25 Cost allocation by operation: Sawing carcass, bruise trimming \$0.0083; weighing, partial scribbling \$0.0039; washing \$0.0039; shrouding, pegging neck \$0.0039.
- 26 For washing operation.
- 27 For shrouding, pegging neck operation.
- 28 Cost allocation by operation: Head workup \$0.0372; transporting viscera \$0.0372.

TABLE 11.--Productive labor requirements per 100 cattle for performing dressing-line operations at the rate of 24 head per hour with the 3-bed system

Operation and time element ¹	500 to 700 pounds (dressed weight)		
	Base time	Fatigue and personal allowance	Productive time
Driving, immobilizing, dry landing:	<u>Man-hours</u>	<u>Percent</u>	<u>Man-hours</u>
<u>Drive</u> - walk from dry landing area to catch pen (av. distance 60 ft.), drive one animal into stunning pen (av. distance 40 ft.).....	1.24	10	1.36
<u>Stun</u> - pick up captive-bolt stunner, shoot animal, release door latch for animal to fall from pen onto dry landing area, eject spent cartridge, place stunner aside, pick up spare stunner, load, and place aside ²	1.04	10	1.14
<u>Walk</u> - from walk alongside of stunning pen to dry landing area (av. distance 8 ft.).....	.06	10	.07
<u>Get Shackle</u> - from shackle return rail at edge of dry landing area, place on hoist.....	.11	10	.12
<u>Shackle</u> - hind legs of immobilized animals.....	.24	15	.28
<u>Hoist</u> - carcass and land on bleeding rail.....	.24	10	.26
<u>Lower hoist</u> - to shackling level.....	.16	10	.18
<u>Wash</u> - floor of working area using hose ³.....	.07	10	.08
Total.....	3.16	--	3.49
Bleeding, skinning head:			
<u>Stick and bleed</u>.....	.19	20	.23
<u>Skin head</u> - remove ears and trim neck hide.....	1.36	20	1.63
<u>Tag</u> - head and carcass.....	.20	10	.22
<u>Transport</u> - carcass within bleeding pit (average distance 15 ft.).....	.23	15	.27
<u>Wash</u> - hands and tools.....	.10	10	.11
Total.....	2.08	--	2.46
Flooring:			
<u>Walk</u> - from bed area to bleed pit, move carcass on rail to bed (av. distance 20 ft.).....	.37	15	.43
<u>Drop carcass</u> - on cradle, remove shackle and carry it to return shackle rail (av. distance 10 ft.).....	1.07	20	1.28
<u>Skin and remove legs</u> - rip hide around hooves, skin legs to just above knee joint, remove legs and throw them into barrel.....	4.07	20	4.88
<u>Side skin</u> - separate and tie weasand, saw brisket, make belly incision, remove udder, or pizzle, open aitch bone.....	6.22	30	8.08
<u>Wash</u> - hands and tools.....	1.16	10	1.28
Total.....	12.89	--	15.95
Rumping, backing, eviscerating:			
<u>Half hoist</u> - lower hoist and spreader in rumping, backing, and eviscerating area and carry spreader to skinning bed (av. distance 15 ft.), attach spreader to trolleys on carcass, drag carcass 15 feet to work area, and hoist to rumping position.....	1.69	15	1.94
<u>Drop bung</u> - make crotch opening, slit tail hide, skin legs and rump, pull fell... ..	2.00	20	2.40
<u>Hoist</u> - carcass to full-hoist position for backing.....	.18	10	.20
<u>Pull hide</u> - from tail.....	.83	15	.96
<u>Skin back</u> - down to neck.....	1.34	10	1.48
<u>Eviscerate</u> - tie bung, detach intestines, paunch, spleen, and pancreas from carcass (except at anterior end) and drop in paunch truck; remove liver and place on tray on truck, cut through diaphragm and complete removal of viscera (including lungs, heart, trachea and esophagus), and drop in paunch truck; cut tail from carcass and place on truck tray.....	1.77	20	2.13
<u>Hoist carcass</u> - and transfer to dressing rail.....	.54	10	.60
<u>Transport carcass</u> - on rail (av. distance 10 ft.) away from work station.....	.31	10	.34
<u>Wash</u> - hands and tools.....	.33	10	.36
Total.....	8.99	--	10.41
Dropping hide:			
<u>Drop hide</u> - push carcass on rail (av. distance 15 ft.), position carcass for work, skin neck, let hide drop to floor, put hide in chute.....	2.95	20	3.54
<u>Wash</u> - hands and tools, walk to next carcass to position it (av. distance 5 ft.).....	.16	10	.18
Total.....	3.11	--	3.72
Sawing carcass, scribing:			
<u>Walk</u> - to carcass, push on rail to saw platform (av. distance 10 ft.).....	.30	15	.35
<u>Step</u> - onto platform, raise platform, spread carcass, position saw, cut tail muscle.....	.48	15	.55
<u>Saw carcass</u> - into halves.....	.98	20	1.18
<u>Release spreader</u>.....	.12	10	.13
<u>Scribe</u> - cut chine bones almost through with scribe saw, and pound them back to give broader effect to back.....	.44	15	.51
<u>Trim</u> - neck area.....	.23	15	.26
<u>Transport</u> - carcass on rail (av. distance 10 feet).....	.19	15	.21
<u>Wash</u> - hands and tools.....	.10	10	.11
Total.....	2.84	--	3.30

TABLE 11.--Productive labor requirements per 100 cattle for performing dressing--III. Operations at low animal to worker ratio in the 3-bed system--(Continued)

Operation and time element ¹	Time in minutes per 100 cattle		
	Man-hours	Truck-hours	Truck-hours
Bruise trimming:			
<u>Walk</u> - to carcass sides and push sides to trim area (av. distance 5 ft.).....	0.01	1	1.00
<u>Ascend</u> - platform and trim sides, descend platform.....	0.01	1	1.00
<u>Transport</u> - sides on rail to wash area (av. distance 10 ft.), return to trim area.....	0.13	1	1.00
Total.....	1.83	--	1.00
Washing:			
<u>Position</u> - sides for washing.....	0.01	1	1.00
<u>Wash</u> - both sides.....	2.91	10	1.00
<u>Transport</u> - sides on rail to shrouding area (av. distance 6 ft.).....	0.14	1	1.00
Total.....	3.24	--	1.00
Shrouding:			
<u>Shroud</u> - both sides.....	0.11	1	1.00
<u>Transport</u> - sides on rail to weighing area (av. distance 8 ft.).....	0.09	1	1.00
<u>Setup</u> - get supply of shrouds, pins, pegs for area ³	0.19	1	1.00
Total.....	3.29	--	1.00
Weighing, pegging neck:			
<u>Peg</u> - neck of both sides.....	0.31	1	1.00
<u>Transport</u> - sides onto track scale (av. distance 10 ft.).....	0.32	1	1.00
<u>Dry hands</u> - on towel, record weight on tally sheet.....	0.38	10	1.00
<u>Tag and stamp</u> - place tag on foreleg of each half carcass and stamp both halves of carcass.....	0.17	10	1.00
<u>Transport</u> - sides off scales (av. distance 5 ft.), walk 10 ft. to next carcass.....	0.23	15	1.00
Total.....	1.41	--	1.00
Head workup:			
<u>Walk</u> - from head flush cabinet to bleeding pit (av. distance 10 ft.), sever head from carcass and carry back to head flush cabinet, place head on hooks in cabinet.....	0.40	15	1.00
<u>Flush</u> - head and wash, dehorn with handsaw or cleaver, place head on head inspection truck.....	2.23	15	1.00
<u>Drop tongue</u> - cut hyoid bones, remove tonsils, loosen tongue and let hang by forejaw.....	0.67	10	1.00
<u>Transport</u> - head inspection truck to head inspection area (av. distance 20 ft.) and return.....	0.05	15	1.00
<u>Wash</u> - hands and tools.....	0.10	1	1.00
<u>Transport</u> - head inspection truck - walk to head inspection area (av. distance 25 ft.), push loaded head inspection truck to head-trimming work area (av. distance 25 ft.) ⁴	0.05	15	1.00
<u>Trim heads</u> - get heads from inspection truck (one at a time), place on head workup table, remove head and cheek meat, tongue, and lips, separate jaws, throw head bones into head-bone chute.....	0.10	15	1.00
<u>Wash tongues</u> ⁴	0.01	10	1.00
<u>Transport</u> - tongues (two at a time) to offal truck (av. distance 5 ft.), hang on truck hooks, return to head workup table ⁵	0.13	1	1.00
<u>Transport</u> - head inspection truck - push empty head inspection truck to head-washing work area (av. distance 10 ft.), return to head-trimming work area ⁴	0.02	20	1.00
<u>Wash</u> - hands and tools ⁵	0.07	10	1.00
Total.....	6.83	--	1.00
Transporting viscera:			
<u>Transport</u> - paunch truck with viscera from eviscerating work stations to pluck table (av. distance 25 ft.), place pluck on table (includes liver, heart, lungs and spleen), push paunch truck 20 feet to paunch table.....	0.50	15	1.00
<u>Dump</u> - viscera onto paunch table lift, push truck to truck sterilizing area (av. distance 6 ft.), rinse truck.....	0.33	15	1.00
<u>Transport</u> - empty paunch truck from sterilizing area to eviscerating work station (av. distance 30 ft.).....	0.32	10	1.00
<u>Transport</u> - edible offal - push offal truck containing livers, hearts, tongues and spleens off killing floor (av. distance 30 ft.), push tub truck of head and cheek meat off floor (av. distance 40 ft.) ⁶	0.03	15	1.00
<u>Wash</u> - floor of supporting operations area intermittently during day.....	0.50	1	1.00

TABLE 11.--Productive labor requirements per 100 cattle for performing dressing-line operations at the rate of 24 head per hour with the 3-bed system--Continued

Operation and time element ¹	500 to 700 pounds (dressed weight)		
	Base time	Fatigue and personal allowance	Productive time
Transporting viscera--Continued:	<u>Man-hours</u>	<u>Percent</u>	<u>Man-hours</u>
Transport - drums of offal (udders, pizzles, tripe and trimmings) from killing floor via drum truck (av. distance 45 ft.) ⁷	0.06	20	0.07
Wash - hands and tools.....	.10	10	.11
Total.....	1.84	--	2.08

¹ Time element occurs 100 times per 100 carcasses unless otherwise noted.

² Frequency of occurrence 110 per 100 carcasses.

³ Frequency of occurrence 1 per 100 carcasses.

⁴ Frequency of occurrence 9 per 100 carcasses.

⁵ Frequency of occurrence 50 per 100 carcasses.

⁶ Frequency of occurrence 4 per 100 carcasses.

⁷ Frequency of occurrence 5 per 100 carcasses.

TABLE 12.--Productive labor requirements per 100 cattle for performing dressing-1100 operations at the main gravity on-ho-rail system

Operation and time element ¹			
	Time element	Time element	Time element
Driving, immobilizing, dry landing:			
The elements and requirements are the same as those listed for the operation with the 3-bed system.			
Total.....	3.16	--	3.16
Bleeding, skinning head, forelegs:			
Stick and bleed.....	.17	--	.17
Skin head - and remove ears and trim neck hide.....	1.00	--	1.00
Tag - head and carcass.....	.10	--	.10
Release rail stops - work stops to allow carcass to move to the various work areas in the bleeding pit.....	.43	10	.43
Skin forelegs - rip hide of each foreleg, cut around hooves and skin leg to just above knee joint, remove leg, throw into chute.....	1.23	15	1.23
Wash - hands and tools.....	.10	10	.10
Total.....	3.01	--	3.01
Legging, first transfer:			
Drop bung - make crotch opening.....	.30	15	.30
Slit tail - hide, free tail for tail clamp.....	.17	15	.17
Skin one hind leg - rip leg to just above knee joint.....	.60	15	.60
Skin - one side of flank.....	.26	15	.26
Remove - one hind leg with skill saw and throw leg into chute.....	.18	20	.18
First transfer - insert transfer hoist hook in gum of free leg, hoist carcass until shackle is slack, remove shackle, release rail work stop for shackle to return to dry landing area.....	.97	15	.97
Skin and remove - second hind leg, rip hide, cut around hoof, skin leg to just above knee joint, remove leg with hand knife and throw leg in chute, skin other side of flank.....	1.03	15	1.18
Release rail stops - work stop to permit the carcass to move to the first transfer station and the cushion stop to allow the carcass to move to the legging, first transfer station.....	.15	10	.17
Wash - hands and tools.....	.10	10	.11
Total.....	3.36	--	3.36
Second transfer, release bung:			
Second transfer - get trolleys from rack and place on spreader suspended from rail, insert hoist hook in gum of free leg, adjust carcass legs to same level, insert trolley hooks in gums of both legs and remove hoist hooks, release rail work stop to allow carcass to move to area where next element of work is performed.....	.75	20	.75
Make belly incision - down to brisket.....	.23	15	.26
Tie - off bladder.....	.16	10	.18
Release bung - and tie.....	.60	15	.69
Rim over belly - on both sides of incision with mechanical knife, skin back of legs, open aitch bone.....	1.17	15	1.34
Release rail stops - work stop to permit carcass to move to next cushion stop to allow the carcass to move to the rumping work station.....	.15	10	.17
Wash - hands and tools.....	.10	10	.11
Total.....	3.16	--	3.65
Rumping:			
Release cushion stop - for carcass to move to rumping area, position carcass for rumping.....	.16	10	.18
Skin rump - with mechanical knife.....	1.84	20	2.21
Release rail stops - work stop for rumped carcass to move to cushion stop and cushion stop to allow carcass to move to tail-pulling area.....	.15	10	.17
Pull tail with hydraulic puller - place tail clamp on spreader, place tail tip in tail clamp, wrap tail around puller and activate hydraulic puller to pull tail hide off tail, sever tail tip, remove tail from puller, take tail clamp from spreader and hang it on work bench.....	.60	15	.75
Wash - hands and tools.....	.10	10	.11
Total.....	2.85	--	3.36
Rimming over, sawing brisket:			
Make - brisket hide incision to neck area.....	.28	15	.32
Rim over - skin both sides of incision with hand knife, rim over on left side with mechanical knife.....	.71	20	.85
Rim over brisket - rim over right side of incision with mechanical knife.....	.64	20	.77
Skin hide - from around both forelegs with hand knife.....	.54	20	.66
Saw brisket - with brisket saw.....	.41	15	.47
Skin hide - from rosette with hand knife.....	.53	15	.61
Make incision - clear gullet.....	.16	15	.18
Release rail stops - cushion and work stops to allow carcasses to move to and from the rimming over, sawing brisket station.....	.15	10	.17
Wash - hands and tools.....	.07	10	.09
Total.....	3.49	--	4.16

TABLE 12.--Productive labor requirements per 100 cattle for performing dressing-line operations at the rate of 24 head per hour with the gravity on-the-rail system--Continued

Operation and time element ¹	500 to 700 pounds (dressed weight)		
	Base time	Fatigue and personal allowance	Productive time
Siding, backing, hide dropping:	<u>Man-hours</u>	<u>Percent</u>	<u>Man-hours</u>
<u>Tie weasand</u> - skin neck area.....	1.13	20	1.35
<u>Step</u> - onto hydraulic platform, activate to working level.....	.19	10	.21
<u>Skin sides</u> - back with mechanical knife, drop hide into chute.....	1.92	20	2.30
<u>Release rail stops</u> - cushion stop to allow carcass to move to siding, backing, and hide dropping station and work stop to allow carcass to move to cushion stop.....	.15	10	.17
<u>Wash</u> - hands and tools.....	.07	10	.08
Total.....	3.46	--	4.11
Eviscerating, bruise trimming:			
<u>Position carcass</u> - on drop-rail.....	.14	15	.16
<u>Lower carcass</u> - to working position.....	.09	10	.10
<u>Eviscerate</u> - the work is the same as performed with the 3-bed system.....	1.77	20	2.13
<u>Remove udder or pizzle</u>.....	.37	20	.44
<u>Hoist carcass</u> - to rail level.....	.12	10	.13
<u>Trim carcass</u> - for bruises.....	.23	15	.26
<u>Release rail stops</u> - cushion stop to allow carcass to move to the eviscerating station, work stop to allow carcass to move to cushion stop.....	.15	10	.17
<u>Clean</u> - work area with squeegee.....	.11	20	.13
<u>Wash</u> - hands and tools.....	.20	10	.22
<u>Wash</u> - work area using hose.....	.36	10	.40
Total.....	3.54	--	4.14
Sawing carcass:			
<u>Position carcass</u> - for sawing.....	.23	10	.25
<u>Raise platform</u> - to work level, cut tail muscle, position carcass saw.....	.22	15	.25
<u>Saw carcass</u> - into halves.....	.98	20	1.18
<u>Scribe</u>.....	.44	15	.51
<u>Trim neck area</u>.....	.23	15	.27
<u>Land carcass</u> - on level dressing rail spur.....	.21	15	.24
<u>Release rail stops</u> - cushion stop to allow carcass to move to carcass-sawing work area, work stop allowing spreader to return to second transfer station....	.15	10	.17
<u>Wash</u> - hands and tools.....	.10	10	.11
Total.....	2.56	--	2.98
High washing, partial shrouding:			
<u>High wash</u> - carcass sides.....	1.32	10	1.45
<u>Pin shroud</u> - on rounds, push sides on rail (av. distance 5 ft.).....	.86	15	.99
<u>Wash</u> - hind legs area.....	.08	10	.09
<u>Setup</u> - shrouds, pins, pegs ².....	.20	15	.23
Total.....	2.46	--	2.76
Low washing, partial shrouding, pegging neck:			
<u>Low wash</u> - sides, push on rail (av. distance 5 ft.).....	1.15	10	1.27
<u>Peg neck</u> - muscle to neck to improve carcass appearance.....	.30	15	.35
<u>Pin shroud</u> - on one carcass side.....	1.16	15	1.33
Total.....	2.61	--	2.95
Weighing, partial shrouding:			
<u>Pin shroud</u> - on one carcass side.....	1.16	15	1.33
<u>Transport</u> - sides on rail to scales (av. distance 5 ft.).....	.14	15	.16
<u>Dry hands</u> - record weight on tally sheet.....	.38	10	.42
<u>Stamp</u> - carcass sides, tag.....	.17	10	.19
<u>Transport</u> - sides off scales (av. distance 5 ft.), walk 10 ft. to next carcass..	.22	15	.26
Total.....	2.07	--	2.36
Head workup:			
<u>Walk</u> - from head flush cabinet to bleeding pit (av. distance 15 ft.), sever head from carcass and carry back to head flush cabinet, place head on hooks in cabinet.....	.48	15	.55
<u>Flush</u> - head and wash, dehorn with handsaw or cleaver, place head on head inspection truck.....	2.23	15	2.56
<u>Drop tongues</u> - cut hyoid bones, remove tonsils, loosen tongue and let hang by forejaw.....	.67	10	.73
<u>Wash</u> - hands and tools.....	.10	10	.11
<u>Transport</u> - head-inspection truck - walk 20 ft. from head workup table to head-washing work area, push loaded head inspection truck (av. distance 15 ft.) to head inspection area, walk to head workup table (av. distance 15 ft.) ⁵.....	.04	15	.05
<u>Trim heads</u> - get heads (one at a time) from head inspection truck, place on head workup table, remove head and cheek meat, tongues, lips, separate jaws and throw head bones into head bone chute. Head and cheek meat into tub truck container.....	3.10	15	3.57
<u>Wash tongues</u> - (12 at a time) ⁵.....	.01	10	.01

TABLE 12.--Productive labor requirements per 100 cattle for performing dressing-line operations at the same as in Table 11, but with gravity on-the-rail system--Continued

Operation and time element ¹	Time element per 100 carcasses		
	Man-hours	Man-hours per 100 carcasses	Man-hours per 100 carcasses
<u>Transport</u> - tongues, carry tongues (two at a time) to offal truck (av. distance 5 ft.), hand on truck hooks, return to head workup table ⁶	0.13	10	1.30
<u>Transport</u> - empty head inspection truck from head-trimming work area to head-washing area (av. distance 10 ft.), return (10 ft.) to head-trimming area ⁵.....	.02	10	.20
<u>Transport</u> - loaded head inspection truck, walk from head-trimming work area to head inspection area (av. distance 10 ft.), push truck to head-trimming work area (av. distance 10 ft.) ⁵.....	.02	10	.20
<u>Wash</u> - hands and tools ⁶.....	.07	10	.70
Total.....	6.87	--	2.40
Transport viscera:			
<u>Transport</u> - paunch truck from eviscerating work station to paunch table lift (av. distance 15 ft.).....	.17	10	1.70
<u>Transport</u> - pluck, manually carry heart, spleen, liver, lungs, and windpipe from paunch truck to pluck table (av. distance 5 ft.), place on table and return to paunch truck.....	.15	10	1.50
<u>Dump</u> - viscera onto paunch table lift, push truck to truck sterilize area (av. distance 6 ft.), rinse truck.....	.33	15	3.38
<u>Transport</u> - empty paunch truck from sterilizing area to eviscerating work station (av. distance 20 ft.).....	.22	10	2.24
<u>Empty drums</u> - of udders, pizzles, tripe and trimmings into offal chute ⁷.....	.04	20	.80
<u>Transport</u> - edible offal, push offal truck containing livers, hearts, tongues and spleens off killing floor (av. distance 35 ft.), move tub truck of cheek meat off floor (av. distance 30 ft.) ⁸.....	.03	15	.45
<u>Wash</u> - hands and tools.....	.10	10	1.10
<u>Wash</u> - floor area of supporting operations work intermittently during day.....	.50	10	5.05
Total.....	1.54	--	1.74

¹ Time element occurs 100 times per 100 carcasses unless otherwise noted.

² Frequency of occurrence 110 times per 100 carcasses.

³ Frequency of occurrence 1 per 100 carcasses.

⁴ Frequency of occurrence 10 per 100 carcasses.

⁵ Frequency of occurrence 9 times per 100 carcasses.

⁶ Frequency of occurrence 50 times per 100 carcasses.

⁷ Frequency of occurrence 5 times per 100 carcasses.

⁸ Frequency of occurrence 4 times per 100 carcasses.

TABLE 13.--Productive labor requirements per 100 cattle for dressing-line operations of the powered on-the-rail system, by time elements

Operation and time element ¹	500 to 700 pounds (dressed weight)		
	Base time	Fatigue and personal allowance	Productive time
	Man-hours	Percent	Man-hours
Driving, immobilizing, dry landing: The elements and requirements are the same as those for the 3-bed system.....			
Total.....	3.16	--	3.49
Bleeding, skinning head, forelegs:			
<u>Stick and bleed</u>.....	.19	20	.23
<u>Skin head</u> - remove ears and trim neck.hide.....	1.36	20	1.63
<u>Tag</u> - head and carcass.....	.20	10	.22
<u>Release rail stops</u> - work stops to allow carcasses to move to the various work areas in the bleeding pit.....	.44	10	.48
<u>Skin forelegs</u> - same as gravity on-the-rail.....	1.23	15	1.41
<u>Wash</u> - hands and tools.....	.10	10	.11
Total.....	3.52	--	4.08
Legging, first transfer:			
<u>Drop bung</u> - make crotch opening.....	.30	15	.35
<u>Slit tail hide</u> - free tail tip for tail clamp.....	.17	15	.20
<u>Skin one hind leg</u> - rip hide, cut around hoof, and skin leg to just above knee joint.....	.60	15	.69
<u>Skin</u> - one side of flank.....	.26	15	.30
<u>Remove</u> - one hind leg with skill saw and throw leg into chute.....	.18	20	.21
<u>Release rail stop</u> - work stop to allow carcass to move to first transfer work area.....	.15	10	.17
<u>Transfer carcass</u> - from bleeding rail to transfer hoist, insert transfer hoist hook in gam of free leg, hoist carcass until shackle is slack, remove shackle, release rail work stop for shackle to return to dry landing area and remove....	.79	15	.91
<u>Skin second hind leg</u> - rip hide, cut around hoof, skin leg to just above knee joint, remove leg with hand knife and throw in chute, skin other side of flank.....	1.03	15	1.18
<u>Wash</u> - hands and tools.....	.10	10	.11
Total.....	3.58	--	4.12
Second transfer, remove udder:			
<u>Move spreader</u> - into position for transfer of carcass.....	.30	10	.33
<u>Transfer carcass</u> - from transfer hoist to spreader on dressing rail, insert transfer hoist hook into gam of free leg and shift weight of carcass by hoisting opposite leg; get and place trolley on each spreader hook, insert trolley hook in gam of slack leg and free hoist hook, level carcass legs, insert trolley hook in gam, remove hoist hook in gam to complete weight shift to spreader; release rail stop for carcass to move onto powered section of rail.....	1.00	20	1.20
<u>Make hide incision</u> - to brisket.....	.23	15	.26
<u>Remove udder or pizzle</u>.....	.37	15	.42
<u>Tie bladder</u>.....	.15	10	.17
<u>Rim over</u> - belly on both sides of incision with mechanical knife and skin back of legs, open aitch bone.....	1.17	15	1.34
<u>Wash</u> - hands and tools.....	.10	10	.11
Total.....	3.32	--	3.83
Rumping, release bung:			
<u>Release bung</u> - tie.....	.60	15	.69
<u>Skin rump</u> - with mechanical knife.....	1.84	20	2.21
<u>Pull tail</u> - with hydraulic puller, work the same as with gravity on-the-rail system.....	.60	15	.69
<u>Wash</u> - hands and tools.....	.10	10	.11
Total.....	3.14	--	3.70
Rimming over, sawing brisket:			
<u>Make</u> - brisket hide incision to neck area.....	.28	15	.32
<u>Rim over</u> - skin both sides of incision with hand knife, rim over on left side with mechanical knife.....	.71	20	.85
<u>Rim over brisket</u> - rim over right side of incision with mechanical knife.....	.64	20	.77
<u>Clear</u> - hide from around both forelegs with hand knife.....	.54	20	.65
<u>Saw brisket</u> - with brisket saw.....	.41	15	.47
<u>Clear</u> - hide from rosette with hand knife.....	.53	15	.61
<u>Make</u> - incision to clear gullet.....	.16	15	.18
<u>Wash</u> - hands and tools.....	.07	10	.08
Total.....	3.34	--	3.93
Siding, backing, hide dropping:			
<u>Tie weasand</u> - skin neck area.....	1.13	20	1.35
<u>Step onto hydraulic platform</u> - activate to working level.....	.19	10	.21
<u>Skin sides</u> - and back with mechanical knife, let hide drop into chute.....	1.92	20	2.30
<u>Wash</u> - hands and tools.....	.07	10	.08
Total.....	3.31	--	3.94

TABLE 13.--Productive labor requirements per 100 cattle for dressing--time operation by time elements--Continued

Operation and time element ¹			
	Min	Sec	Min
Eviscerating, separating paunch:			
Lower carcass - with drop-rail to working height.....	1.1	1	1.1
Eviscerate - remove viscera from carcass onto moving viscera inspection table. (The work is the same as in the 3-bed and gravity system).....	1.77		1.77
Separating paunch - tie off and sever section of bung and bladder; tie off paunch and sever; remove liver, spleen; tie off and remove section of gutlet...	1.1	1	1.1
Hoist carcass - to rail level.....	.1		.1
Wash - hands and tools at equipment washstand adjacent to viscera conveyor.....	.27		.27
Total.....	4.4	--	4.4
Sawing carcass, bruise trimming:			
Step on hydraulic platform - from trim platform, raise platform to work level, cut tail muscle, position carcass saw.....	.50	15	.50
Saw carcass - into halves.....	.98	20	.98
Transfer carcass - from powered rail to gravity rail.....	.21	15	.21
Cut - chine bones with mechanical scribe saw.....	.22	15	.22
Release rail stop - work stop to allow carcass sides to trimming station, work stop at trimming station to allow carcass sides to move to weighing work area.....	.15	10	.15
Step on trim platform - raise platform to work level, trim carcass sides for bruises.....	.99	10	.99
Wash - hands and tools.....	.10	10	.10
Total.....	3.15	--	3.15
Weighing and partial scribing:			
Use hand scribe - saw to flatten back of each side.....	.54	15	.54
Transport - carcass sides onto scales (av. distance 10 ft.), dry hands.....	.39	15	.39
Print ticket - and record weight on tally sheet.....	.65	10	.65
Transport - carcass sides on rail to wash area (av. distance 8 ft.), walk 15 feet to next carcass.....	.23	15	.23
Total.....	1.81	--	1.81
Washing:			
Wash carcass sides - from hydraulic platform.....	2.55	10	2.55
Position - next carcass sides for washing.....	.29	15	.29
Transport - carcass sides on rail to shroud area (av. distance 5 ft.), worker descends platform and returns to platform.....	.25	15	.25
Total.....	3.09	--	3.09
Shrouding and pegging neck:			
Peg neck - of both carcass sides.....	.31	15	.31
Shroud - carcass sides (steps on hydraulic platform).....	2.41	15	2.41
Stamp - sides.....	.12	10	.12
Descend - platform, transport sides 5 feet out of shroud area, walk 10 feet to next carcass to be pegged.....	.37	15	.37
Setup - shrouds, pins, pegs ².....	.19	15	.19
Total.....	3.40	--	3.40
Head workup:			
Walk - from head flush cabinet to bleeding pit (av. distance 5 ft.), sever head from carcass and carry head to dehorn table (av. distance 10 ft.).....	.35	15	.35
Dehorn - using portable air-driven saw. Trim any hide left around base of horns..	.90	15	.90
Flush head - carry head to head flush cabinet (av. distance 5 ft.), flush and wash head.....	1.90	15	1.90
Transport head - to head inspection truck (av. distance 5 ft.), remove tonsils, cut hyoid bones.....	.36	10	.36
Wash - hands and tools.....	.10	10	.10
Transport - head inspection truck - walk to head inspection area (av. distance 25 ft.), push loaded head inspection truck to head-trimming work area (av. distance 25 ft.), ⁴.....	.05	15	.05
Trim heads - get heads (one at a time) from head inspection truck, place on head workup table, remove head and cheek meat, tongues and lips, separate jaws, throw head bones into head bone chute, head and cheek meat into chute....	3.10	15	3.10
Wash tongues - throw into tongue chute ⁴.....	.01	10	.01
Transport - head inspection truck - push empty truck from head-trimming work area to head-washing work area (av. distance 15 ft.), return to head-trimming area ⁴.....	.02	10	.02
Transport - head inspection truck - walk to head-washing area (av. distance 15 ft.), push loaded head inspection truck to head-inspection area (av. distance 30 ft.), return (25 ft.) to head-trimming work area ⁴.....	.05	15	.05
Drop tongues - and let hang by forejaw.....	.30	10	.30
Wash - hands and tools ⁵.....	.07	10	.07
Total.....	7.21	--	7.21

TABLE 13.--Productive labor requirements per 100 cattle for dressing-line operations of the powered on-the-rail system,
by time elements--Continued

Operation and time element ¹	500 to 700 pounds (dressed weight)		
	Base time	Fatigue and personal allowance	Productive time
Transporting viscera:			
<u>Remove</u> - heart, liver, lungs, spleen from moving-top viscera inspection conveyor and put into pluck chute.....	<u>Man-hours</u> 0.53	<u>Percent</u> 10	<u>Man-hours</u> 0.58
<u>Guide</u> - paunch into chute at end of moving conveyor.....	.39	10	.43
<u>Wash</u> - hands and tools.....	.10	10	.11
<u>Wash</u> - floor area of supporting operations work intermittently during day.....	.50	10	.55
Total.....	1.52	--	1.67

¹ Time element occurs 100 times per 100 carcasses unless otherwise noted.

² Frequency of occurrence 110 per 100 carcasses.

³ Frequency of occurrence 1 per 100 carcasses.

⁴ Frequency of occurrence 9 per 100 carcasses.

⁵ Frequency of occurrence 50 per 100 carcasses.

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